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absolute performance: performance [power, heat rate (efficiency), exhaust temperature, exhaust flow exhaust energy] of the gas turbine at a specific point in time. (PTC 22-2014)

absolute pressure transmitter: an instrument that measures pressure referenced to absolute zero pressure and transmits the information. (PTC 51-2011)

absolute pressure, pa: the value of a pressure when the datum is absolute zero; it is always positive. (PTC 11-2008)

absolute pressure: algebraic sum of the atmospheric pressure and gage pressure. (PTC 4.4-2008, PTC 39-2005, PTC 51-2011)

absolute sensitivity (influence) coefficient: unit change in result per unit change of the measured parameter. (PTC 4.3-2017)

absolute temperature, T: the value of temperature when the datum is absolute zero. It is measured in kelvins or degrees Rankine. The absolute temperature in degrees Rankine is the temperature in degrees Fahrenheit plus 459.7, and the absolute temperature in kelvins is the temperature in degrees Celsius plus 273.2. (PTC 11-2008)

absolute uncertainty: see uncertainty (PTC 11-2008)

absorption: see sound absorption. (PTC 36-2018)

absorption dynamometer: a device that may be connected to the output shaft of a turboshaft engine in place of the driven load, which absorbs the output of the turboshaft engine while transmitting the torque to stationary member where it can be measured accurately. (PTC 55-2013)

absorption dynamometer: device that may be connected to the output shaft of a prime mover in place of the driven load, which absorbs the output of the prime mover while transmitting the torque to a stationary member where it can be measured accurately. (PTC 47-2006)

acceleration of gravity: constant used in Nusselt equation (PTC 12.2-2010)

acceptance test: a test conducted to determine if a piece of equipment meets the performance requirements of the purchase contract and is hence accepted. (PTC PM-2010)

acceptance test: test conducted to determine if a new or modified piece of equipment satisfactorily meets its performance criteria, permitting the purchaser to accept it from the supplier. (PTC 1-2015)

acceptance test: the evaluating action(s) or procedure to determine if a new or modified piece of equipment satisfactorily meets its performance criteria, permitting the purchaser to “accept” it from the supplier. (PTC Template, PTC 4.3-2017, PTC 46-2015, PTC 47.4-2015, PTC 11-2008, PTC 29-2005, PTC 30.1-2009, PTC 47.1-2017, PTC
acceptance test: the field performance test to determine if a new or modified machine satisfactorily meets its performance criteria. (PTC 18-2011)

accuracy check: the process of comparing the response of an instrument to a standard over some measurement range (also see calibration). (PTC 4.3-2017)

accuracy: the closeness of agreement between a measured value and the true value (see also uncertainty); the arithmetic average of a repeated measured value compared to the true value. (PTC 34-2017)

accuracy: the closeness of agreement between a measured value and the true value. (PTC Template, PTC 4.3-2017, PTC 47.4-2015, PTC 47.1-2017, PTC 19.6-2018)

accuracy: the closeness of agreement between a measured value and the true value. Since accuracy varies with measurement device type and the manufacturer, the manufacturer should be consulted for their precise definition. (PTC 19.2-2010)

accuracy class: guaranteed worst-case accuracy for all devices of a particular type, model, or design over their intended operating range. Usually refers to meters and instrument transformers. Accuracy of individual units may be much better than the class accuracy, but testing is required to discover the actual value. (PTC 19.6-2018)

acid dewpoint: temperature at which the acid in the gas condenses. Generally, sulfuric acid is considered to be the most critical compound in the gas for which acid dew point needs to be determined. (PTC 4.4-2008)

acid gas removal process: process that removes one or more of the acid gas components from the syngas, also referred to as the gas cleanup process. NH3, HCN, and HCl have several and varied methods of removal, such as a water wash, which goes to subsequent water cleanup before discharge. See ambient temperature acid gas removal process, cold acid gas removal process, and hot acid gas removal process. (PTC 47-2006)

acid gas: contaminants in the syngas, consisting of hydrogen sulfide (H2S), carbonyl sulfide (COS), and carbon dioxide (CO2). Acid gas may also refer to a concentrated stream of one or more of these components. (PTC 47-2006)

acidity: expression of the concentration of hydrogen ions present in a solution. (PTC 31-2011)

acoustic, acoustical: qualifying adjectives meaning containing, producing, arising from, actuated by, related to, or associated with sound. Acoustic is used when the term being qualified designates something that has the properties, dimensions, or physical characteristics associated with sound waves. Acoustical is used when the term being qualified does not explicitly designate something that has such properties, dimensions, or physical characteristics. (PTC 36-2018)

active power [expressed in watts (W)]: amount of power delivered to the resistive component of a load. Active power is the only power that can perform useful work. In a DC circuit, active power is volts multiplied by amps. In an AC circuit with sinusoidal waveforms, active power is RMS volts multiplied by RMS amps and the cosine of the phase difference between them. (See apparent power and reactive power.) (PTC 19.6-2018)

actual discharge area: the measured minimum net area that determines the flow through a valve. (PTC 25-2018)

additive: a substance added to a gas, liquid, or solid stream to cause a chemical or mechanical reaction. (PTC 4-2013, PTC 4.3-2017)

additive: a substance added to a gas, liquid, or solid stream to cause a desired chemical or mechanical effect. (PTC 34-2017)

additive: substance added to a liquid or gas stream to cause a chemical or physical reaction to enhance the SO2 sorption process; generally, the additive is not consumed as part of the absorption reaction. (PTC 40-2017)

additive: substance added to a gas, liquid, or solid stream to cause a chemical or mechanical reaction to enhance collection efficiency. (PTC 47-2006)
adjusting ring: a ring assembled to the nozzle or guide of a direct spring valve used to control the opening characteristics and/or the reseat pressure. (PTC 25-2018)

adjustment screw: a screw used to adjust the set pressure or the reseat pressure of a reclosing pressure relief device. (PTC 25-2018)

adjustment: (a) starting equipment, stopping equipment, or changing the set point of equipment during a test run. (b) correction of test parameters to guarantee conditions. (PTC 30.1-2007)

afterburner: a type of combustor (augmentor, reheater) where thermal energy is added to the gas generator exhaust and the fan bypass flow to provide additional thrust. (PTC 55-2013)

aftercooler: heat exchanger for cooling a fluid, following the last stage of compression. (PTC 47-2006)

agglomerating ash gasifier: type of fluid-bed gasifier that contains a hot zone in which the ash particles are agglomerated into small pellets for removal. (PTC 47-2006)

air blanketing: accumulation of noncondensible gases on the steam side of heat exchanger tubes resulting in a reduction in heat transfer. (PTC PM-2010)

air density, standard: air at density of 0.075 lbm/ft³ (1.201 kg/m³). (PTC 23-2003, PTC 51-2011)

air density: mass of air per unit volume. (PTC 23-2003, PTC 51-2011)

air flow, mass: mass of dry air flowing through the tower for reducing circulating water temperature. (PTC 23-2003)

air flow, volume: volume of air mixture flowing through the tower for reducing circulating water temperature. (PTC 23-2003)

air heater air-to-air leakage: air that leaks from a high pressure air stream to a lower pressure air stream, e.g., primary air to secondary air leakage. (PTC 4.3-2017)

air heater effectiveness: the ratio of the gas side efficiency to the X-ratio. (PTC PM-2010)

air heater gas side efficiency: the ratio of the actual drop in flue gas temperature through the air heater to the maximum drop possible. (PTC PM-2010)

air heater leakage: leakage of air from the air side to the gas side expressed in percent of total gas flow entering air heater. (PTC PM-2010)

air heater leakage: mass of airflow passing from all air side streams to the heat transfer fluid. Note that this calculated value will include any ingress air that may be present between the air heater gas inlet and gas outlet test planes. (PTC 4.3-2017)

air heater leakage: the total amount of air leakage from the air stream(s) to the flue gas stream within the air heater expressed as a percentage of the entering flue gas flow. (PTC 4-2013)

air heater: a heat exchanger that transfers heat from a high temperature medium such as hot gas to an incoming air stream, usually recovering heat from hot gas exiting from the boiler bank or economizer. (PTC 34-2007)

air heater: a heat exchanger that transfers heat from a high temperature medium such as hot gas to an incoming air stream. Regenerative air heaters include bisector and trisector types, with fixed or rotating heating elements. Recuperative air heaters include tubular, plate, and heat pipe types. (PTC 4-2013)

air heater: a heat exchanger that transfers heat from a high-temperature medium, e.g., hot gas, to an incoming air stream. Regenerative air heaters include bi-sector, tri-sector, and quad-sector types with fixed or rotating heating elements. Recuperative air heaters include tubular, plate, and heat pipe types. (PTC 4.3-2017)

air heater: device to transfer heat from the flue gas to the air entering the boiler (recuperative or regenerative).
air in-leakage: measured rate of standard air in-leakage into condenser at 1 atm (14.7 psia) and 15.568C (608F) as discharged from the air-removal system (PTC 12.2-2010)

air integrated air separation unit: air separation process that receives all, or a part of, the total air feed requirement by extraction of a portion of the compressed air from the gas turbine. (PTC 47-2006)

air preheater coils: a heat exchanger that typically uses steam, condensate, and/or glycol to heat air entering the steam generator and is often used to control corrosion in regenerative and recuperative air heaters. (PTC 4.3-2017)

air preheater coils: a heat exchanger that typically uses steam, condensate, and/or glycol to heat air entering the steam generator and is often used to control corrosion in regenerative and recuperative air heaters. (PTC 4-2013)

air preheater coils: a heat exchanger that typically uses steam, condensate, and/or glycol to heat combustion air entering the steam generator system. (PTC 34-2017)

air preheater: device that controls the air temperature into the air heater so as to maintain the exit gas temperature above a minimum level. (PTC PM-2010)

air pretreatment: a unit that removes water, carbon dioxide, and some hydrocarbon contaminants from the compressed air stream prior to processing in the cryogenic sections of the ASU. Pretreatment is usually based on a cyclical, adsorption/desorption (molecular sieve) based ambient temperature process using heated, dry nitrogen produced by the ASU for regeneration of the adsorbent. (PTC 47-2006)

air temperature rise: the increase in temperature of the airflow passing through the air heater. For multi-sector air heaters, this parameter is defined as the composite air temperature increase of the total airflow (from all streams) passing through the air heater. (PTC 4.3-2017)

air, corrected theoretical: the theoretical air adjusted for unburned carbon and additional oxygen required to complete the sulfation reaction. (PTC 4.3-2017)

air, corrected theoretical: the theoretical air adjusted for unburned carbon and additional oxygen required to complete other reactions, i.e., the sulfation reaction. (PTC 47-2006)

air, corrected theoretical: the theoretical air adjusted for unburned carbon and additional oxygen required to complete the sulfation reaction. (PTC 4-2013)

air, corrected theoretical: theoretical air adjusted for unburned carbon. (PTC 34-2017)


air, excess: air supplied to burn a fuel in addition to the corrected theoretical air. Excess air is expressed as a percentage of the corrected theoretical air in this Code. (PTC 4.3-2017)

air, excess: air supplied to burn a fuel in addition to the minimum necessary for complete combustion. Excess air is expressed as a percentage of the corrected theoretical air in this Code. (PTC 47-2006)

air, excess: the air supplied to burn a fuel in addition to the corrected theoretical air. Excess air is expressed as a percentage of the corrected theoretical air in this Code. (PTC 4-2013)

air, excess: the air supplied to burn a fuel in addition to the theoretical air necessary for complete combustion of the fuel; it is expressed as a percentage of the corrected theoretical air in this Code for complete combustion. (PTC 34-2017)

air heater: a heat exchanger that transfers heat from a high-temperature medium such as hot gas to an incoming air stream, usually recovering heat from hot gas exiting from the boiler bank or economizer. (PTC 34-2007)

air, infiltration/ingress: air that leaks into the steam generator and/or air heater setting (same as setting infiltration). (PTC 4.3-2017)
air, infiltration: air that leaks into the steam generator setting. (PTC 4-2013)

air, infiltration: influx of air into the steam generator envelope. (PTC 47-2006)

air, infiltration: the leakage of air into the steam generator system envelope, also referred to as tramp air. (PTC 34-2017)

air, inlet: air crossing the test boundary and entering power plant equipment. Because of local effects, the properties of inlet air may not be the same as the properties of ambient air. (PTC 47.4-2015)

air, other: a number of other combustion air arrangements and splits (e.g., overfire air, tertiary air) are encountered in the combustion processes covered by this Code. (PTC 4-2013)

air, other: any air supplied to the system that is not primary or secondary air. A number of other combustion air arrangements and splits are encountered in the combustion processes covered by this Code. The user must be thoroughly familiar with the combustion air arrangement of the steam generator being tested when applying this Code. (PTC 34-2017)

air, other: combustion air other than primary air, secondary air, and infiltration air, e.g., tertiary air, that is encountered in the combustion processes covered by this Code. (PTC 4.3-2017)

air, primary: air supplied through or with a waste/fuel to initiate and sustain combustion. This air is usually supplied through the fuel bed and may be at ambient temperature or heated to induce drying fuel; it is also referred to as undergrate air or underfire air. (PTC 34-2017)

air, primary: the transport and drying air for the coal from the pulverizers to the burners in pulverized coal fired applications. The primary air is often a temperature different from that of the secondary air as it leaves the regenerative air heaters in large steam generators, and typically represents less than 25% of the total combustion air. Oil and gas fired steam generators usually do not have primary air. Primary air is the air used for fluidizing the bed material at the base of the combustion chamber in circulating fluidized beds. (PTC 4-2013, PTC 4.3-2017)

air, secondary: air supplied above the zone where burning is initiated. This air, at ambient temperature or heated, may be used to stimulate mixing of the burning combustible gases and suspended solids to ensure complete combustion, and/or to reduce furnace temperature, and/or to introduce additives; it is also referred to as over-fire air. (PTC 34-2017)

air, secondary: secondary air is the balance of the combustion air not provided as primary air in pulverized and fluid bed applications. All of the combustion air leaving the air heater is usually referred to as “secondary air” in oil and gas fired steam generators. Secondary air may be split into overfire air or other streams as it enters the furnace; however, it remains secondary air up to and including the wind box. (PTC 4-2013, PTC 4.3-2017)

air, theoretical: amount of air required to supply the exact amount of oxygen necessary for complete combustion of a given quantity of fuel. Theoretical air and stoichiometric air are synonymous. (PTC 4.3-2017, PTC 47-2006)

air, theoretical: the amount of air required to supply the exact amount of oxygen necessary for complete combustion of a given quantity of fuel. “Theoretical air” and “stoichiometric air” are synonymous. (PTC 4-2013)

air, theoretical: the quantity of air required to supply the exact quantity of oxygen necessary for complete combustion of a given quantity of fuel. (Theoretical air and stoichiometric air are the same.) (PTC 34-2017)

air: mixtures of dry gases and associated water vapor surrounding the earth; dry air plus its associated water vapor. (PTC 51-2011)

air: mixtures of gases and associated water vapor surrounding the earth; dry air plus its associated water vapor. The term is used synonymously with atmosphere. (PTC 23-2003)

air: the natural atmospheric mixture of nitrogen, oxygen, water vapor, carbon dioxide, argon, neon, and small quantities of other rare gases. See para. 5-9.1. (PTC 34-2017)
air-assisted nozzle: fluid atomization device that incorporates an energized stream of air to facilitate atomization of the liquid. (PTC 51-2011)

air-blow gasifier: gasification process in which the oxidizing agent is supplied as air rather than oxygen. (PTC 47-2006)

airborne sound: sound that arrives at the point of interest by propagation through air. (PTC 36-2018)

air-cooled condenser (ACC): a heat exchanger using ambient air as the heat sink to absorb heat directly from steam at vacuum conditions, condensing the steam and recovering the condensate, as would be typically used in an electric power generating station. (PTC 30.1-2007)

airflow, mass: mass of dry air flowing through a piece of equipment (e.g., a cooling tower, GT inlet duct, etc.) (PTC 51-2011)

airflow, volume: volume of air mixture flowing through a piece of equipment (e.g., a cooling tower, GT inlet duct, etc.) (PTC 51-2011)

air-removal system: a system of steam-jet air ejectors (SJAEs) and/or liquid-ring vacuum pumps (LRVPs) in any combination, intended to remove the noncondensibles and maintain the capability of the ACC and support operation of the vacuum deaerator. The air removal system is typically supplied and tested as part of the ACC. Also called “vacuum system”. (PTC 30.1-2007)

alkalinity "M" (total alkalinity): the total titratable alkalinity down to the pH of 4.3. It represents hydroxide carbonate and bicarbonate ions in the water. (PTC 31-2011)

alkalinity “P” (phenolphthalein): the titratable alkalinity down to pH 8.2. It represents the hydroxide carbonate ions in the water. (PTC 31-2011)

alkalinity: expression of the total basic anions (hydroxyl groups) present in a solution. It also represents, particularly in water analysis, the bicarbonate, carbonate, and occasionally, the borate, silicate, and phosphate salts that will react with water to produce the hydroxyl groups. (PTC 31-2011)

alkalinity: capacity of an alkaline material to neutralize SO2. (PTC 40-2017)

alkalinity, reactive: alkalinity determined by acid titration and expressed as moles of alkali per mole of SO2 (absorbed or inlet). (PTC 40-2017)

alkalinity, total: theoretical expression of alkalinity determined from a chemical analysis of the material. (PTC 40-2017)

all volatile treatment: usually meaning treatment composed of ammonia, morpholine or other neutralizing amines, and hydrazine or other volatile oxygen scavengers, which leave no solids on evaporation. (PTC 19.11-2008)

altitude test cell: engine tested at simulated altitude conditions (both inlet and exhaust). (PTC 55-2013)

ambient air temperature: the temperature of the air measured upwind of the ACC within its air supply stream. (PTC 30.1-2007)

ambient air: this Code recognizes that significant differences in both the measured and corrected performances may result, depending upon what physical location(s) is used to represent the contract ambient, design ambient, and test ambient air conditions. Because contractual language may not always resolve the meaning of ambient, this Code requires the parties to the test to agree prior to the test upon which location(s) will be used to represent the ambient air condition. For example, ambient conditions may be considered to be the average of several different locations within the boundary of the site or may be the physical air inlet of equipment such as the gas turbine or the cooling tower. Once the parties have agreed upon the representative location(s), the word ambient as used in the Code shall mean the physical properties of the air at that location(s). (PTC 47-2006)

ambient noise: all encompassing sound or noise associated with a given environment, usually a composite of sounds from many sources. When the intent is to measure or record a specific source or signal, the ambient noise
ambient temperature acid gas removal process: acid gas removal process operating at 90°F to 120°F, usually employing a chemical or mixed chemical/physical solvent to react with the acid gases, followed by regeneration of the solvent by heating. Examples of solvents and processes include methyl diethanolamines (MDEA), Sulfinol, Purisol, Selexinol, and Selexol. (PTC 47-2006)

ambient temperature: temperature of the atmosphere measured windward of the tower. (PTC 23-2003)

ambient temperature: temperature of the atmosphere. (PTC 51-2011)

ambient temperature: the temperature of the air surrounding the HRSG. (PTC 4.4-2008)

ambient temperature: static dry bulb temperature considered to be site specific and monitored at mutually agreed-upon location(s) inside the boundary. (PTC 47.4-2015)

ambient wind velocity: the speed and direction of the wind measured upwind of the ACC within its air supply stream. (PTC 30.1-2007)

amine cycle: operation of a cation exchange cycle in condensate polishers wherein the removal of specified cations from the influent condensate is accomplished by exchange with an equivalent amount of amine ion from the exchange material. (PTC 31-2011)

ammonia injection grid: a system of pipes to introduce ammonia into the GTE for reaction with NOx in the presence of catalyst to form nitrogen and water. (PTC 4.4-2008)

analog signal: a nominally continuous electrical signal that varies in some direct correlation with another signal impressed on a transducer. (PTC 19.22-2007)

analog-to-digital (A/D) converter: a device that converts an analog signal to a digital signal that represents equivalent information. (PTC 19.22-2007)

analysis, proximate: laboratory analysis, in accordance with the appropriate ASTM standard, of a fuel sample providing the mass percentages of fixed carbon, volatile matter, moisture, and noncombustibles (ash). (PTC 4-2013, PTC 4.3-2017, PTC 47-2006)

analysis, ultimate: laboratory analysis of a fuel sample providing the mass percentages of noncombustibles (ash), carbon, hydrogen, nitrogen, sulfur, oxygen, chlorine, and moisture. (PTC 34-2017)

analysis, ultimate: laboratory analysis, in accordance with the appropriate ASTM standard, of a fuel sample providing the mass percentages of carbon, hydrogen (excluding hydrogen in moisture), oxygen (excluding oxygen in moisture), nitrogen, sulfur, moisture, and ash. (PTC 4.3-2017)

analysis, ultimate: laboratory analysis, in accordance with the appropriate ASTM standard, of a fuel sample providing the mass percentages of carbon, hydrogen, oxygen, nitrogen, sulfur, moisture, and ash. (PTC 4-2013, PTC 47-2006)

anion exchange material, intermediate base: ion exchange material containing a mixture of weakly basic and strongly basic groups. The properties of this resin are intermediate between the weak and strong base anion exchangers. (PTC 31-2011)

anion exchange material, strong base: ion exchange material containing the highly ionized quaternary ammonium functional group. It can remove both the highly dissociated strong acids (sulfuric, hydrochloric, nitric, etc.) and the weakly dissociated weak acids (carbonic, silicic, etc.). (PTC 31-2011)

anion exchange material, weak base: ion exchange material containing the polyamine functional group. It is highly ionized in the salt form and can operate only when pH is below 7. Weakly ionized in the free base form, it has little, if any, salt-splitting capacity and can remove the anionic component of strong acids (sulfuric, hydrochloric, nitric, etc.) only. (PTC 31-2011)
anion exchange material: ion exchange material capable of the reversible exchange of negatively charged ions. (PTC 31-2011)

anion: negatively charged ion, such as chloride ($Cl^-$), sulfate ($SO_4^-$), nitrate ($NO_3^-$), carbonate ($CO_3^-$), fluoride ($F^-$), bromine ($Br^-$), carbon dioxide ($CO_2$), and silica ($SiO_2$). (PTC 31-2011)

anions, total exchangeable: numeric sum of the anions listed above including the anions from carbon dioxide and silica, with all being expressed as calcium carbonate ($CaCO_3$) equivalents. (PTC 31-2011)

anions, total: numeric sum of the anions listed above except carbon dioxide and silica, with all being expressed as a calcium carbonate ($CaCO_3$) equivalents. (PTC 31-2011)

apparent power [expressed in volt-amperes (VA)]: total power that is delivered to a circuit that contains both resistive and reactive loads. Apparent power is the square root of the sum of the squares of the active and reactive powers. (See active power and reactive power.) (PTC 19.6-2018)

approach temperature: the difference between the saturation temperature in the drum and the water temperature entering the drum. (PTC 4.4-2008)

approach: difference between cold water temperature and entering wet-bulb temperature. (PTC 23-2003, PTC 51-2011)

area: the outside surface area, including tube surface and fin surface; the area used as the basis for heat-transfer calculations. (PTC 30.1-2007)

arithmetic mean diameter (AMD): see D₁₀ (PTC 51-2011)

array: numeric description of the number of modules contained in the stages or passes in the system. (PTC 31-2011)

as-fired fuel: fuel in the condition as it enters the steam generator system boundary. (PTC 4-2013, PTC 4.3-2017, PTC 34-2017)

as-fired fuel: fuel in the condition as it enters the unit boundary. (PTC 47-2006)

ash fusion temperatures: four temperatures (initial deformation, softening, hemispherical, and fluid) determined for a given fuel ash as determined by the appropriate ASTM standard. Frequently used in the singular to indicate only the softening temperature—the temperature at which the test cone has deformed to a shape whose height and width are equal. (PTC 4-2013)

ash fusion temperatures: four temperatures (initial deformation, softening, hemispherical, and fluid) determined for a given fuel ash as determined by the appropriate ASTM standard. This is frequently used in the singular to indicate only the softening temperature, the temperature at which the test cone has deformed to a shape whose height and width are equal. (PTC 47-2006)

ash pit: a pit or hopper located below a furnace where residue is collected and removed. (PTC 4-2013, PTC 4.3-2017)

ash pit: a storage pit, hopper, or bunker located below a furnace where residue is collected and removed; may also be called discharger or quench tank. (PTC 34-2017)

ash, bottom: all residue removed from the combustion chamber other than that entrained in the flue gas leaving the steam generator boundary. (PTC 4.3-2017)

ash, bottom: all residue removed from the combustion chamber other than that which is entrained in the flue gas; includes siftings. (PTC 4-2013 except for “includes siftings”), (PTC 34-2017)

ash, bottom: all residues removed from the gasification chamber other than that which is entrained in the flue gas; slag from an entrained gasifier, the ash that is rejected in a fluidized bed gasifier for being too large in particle size, or particularly the bottom ash from a nonslagging gasifier. (PTC 47-2006)
ash, fly: ash components from the gasified material which are not captured in the slag. (PTC 47-2006)

ash, fly: particles of residue entrained in the flue gas leaving the steam generator boundary. (PTC 4-2008, PTC 4.3-2017)

ash, fly: the particles of residue entrained in the flue gas leaving the waste combustor-steam generator system boundary. (PTC 34-2007)

ash, hopper: residue extracted from the steam generator at locations beyond the furnace such as boiler bank hoppers, air heater hoppers, and economizer hoppers. (PTC 34-2017)

ash, other: residue extracted from the steam generator at locations such as boiler bank hoppers, air heater hoppers, and economizer hoppers. (PTC 4-2013)

ash: noncombustible mineral matter constituent of fuel that remains after complete burning of a fuel sample in accordance with appropriate ASTM standards. (PTC 4-2013, PTC 4.3-2017, PTC 47-2006)

ash: the inherent noncombustible materials contained in the fuel; see also residue. (PTC 34-2017)

atmosphere: see air. (PTC 51-2011)

atmospheric pressure: force per unit area exerted by the atmosphere at the location of the ACC. (PTC 30.1-2007)

atmospheric pressure: force per unit area exerted by the atmosphere. Standard atmospheric pressure is 760mm of mercury at 0°C. This is equivalent to 101.325 kPa and 14.696 psia. (PTC 39-2005)

atomizing nozzle: a nozzle design to develop water droplets less than 200 μm in diameter. (PTC 51-2011)

attemperation flow: see desuperheating flow. (PTC PM-2010)

attemperator: see desuperheater. (PTC 4-2013, PTC 34-2017, PTC 47-2006)

auxiliary consumption: electrical or thermal energy used in the operation of a gas turbine inlet air-conditioning device or elsewhere as defined by the test boundary. (PTC 51-2011)

auxiliary electrical power: power used to operate the generating unit’s auxiliary equipment. (PTC PM-2010)

auxiliary equipment: equipment needed to support the operation of the boiler, turbine, and condenser cycles. (PTC PM-2010)

auxiliary firing: combustion of fuel in the HRSG to raise the GTE temperature and increase steam capacity. (PTC 4.4-2008)

auxiliary fuel: see supplemental fuel. (PTC 34-2017)

auxiliary load: see auxiliary consumption. (PTC 51-2011)

auxiliary power: electrical power consumed by all users in the IGCC plant. This power consumption is subtracted from the gross power output, measured at the gas and steam turbine generators’ terminals, to obtain net plant power output. (PTC 47-2006)

auxiliary power: electrical power used in the operation of the gas turbine or elsewhere as defined by the test boundary. (PTC 22-2014)

auxiliary power: electrical power consumed by equipment in an IGCC power block plant during normal operation of the power plant. This power consumption is subtracted from the gross power output, measured at the gas and steam turbine generators’ terminals, to obtain net power block output. Depending on the contractual agreement, auxiliary power can include common supply and/or the intermittent power, such as that for water treatment, HVAC, and lighting. (PTC 47-2006)
auxiliary power: electrical power used in the operation of the gas turbine power plant or elsewhere as defined by the test boundary. (PTC 70-2009)

auxiliary system: any system that uses fluids other than steam or water and exchanges energy with the GTE. These systems include air heaters, air coolers, fuel heaters, etc. (PTC 4.4-2008)

availability: measure of a unit’s ability to provide power compared to its full load capacity. (PTC PM-2010)

A-weighted sound level: a sound level to which an A-weighting electrical filter, or its equivalent, has been applied that conforms with ANSI/ASA S1.4/Part 1/IEC 61672-1. This filter attenuates low- and high-frequency sound. (PTC 36-2018),


backflow preventer: a part or feature of a pilot-operated pressure relief valve used to prevent the valve from opening and flowing backwards when the pressure at the valve outlet is greater than the pressure at the valve inlet. (PTC 25-2018)

background noise: total of all sources of interference in a system used for the production, detection, measurement, or recording of a signal, independent of the presence of the signal. Ambient sound detected, measured, or recorded with the signal is part of the background noise. Included in the definition of background noise is the interference resulting from primary electric power supplies that are commonly described as hum. (PTC 36-2018)

back pressure: the static pressure existing at the outlet of a pressure relief device due to pressure in the discharge system. (PTC 25-2014)

back pressure: see turbine exhaust pressure. (PTC PM-2010)

backwash: reverse flow of water through the media to fluidize and reclassify the bed to remove suspended matter and fines. (PTC 31-2011)

balance method: sometimes called the heat balance method. A method of determining steam generator efficiency by a detailed accounting of all energy entering and leaving the steam generator envelope. (PTC 34-2007)

barometric pressure: force per unit area exerted by the atmosphere. (PTC 51-2011)

base load: a GTG operating on its control curve wherein the power produced is nominally 100%. (PTC 4.4-2008)

base reference conditions: the values of all the external parameters; i.e., parameters outside the test boundary to which the test results are corrected. Also, the specified secondary heat inputs and outputs are base reference conditions. (PTC 46-2015, PTC 50-2002, PTC 51-2011)

base reference conditions: the values of all the external parameters, i.e., parameters outside the test boundary to which the test results are corrected. (PTC 29-2005, PTC 47.1-2017)

basin: an open structure located beneath the tower fill for collecting the circulating water. (PTC 23-2003)

basin curb: the top elevation of the tower basin, usually the datum from which tower elevations are measured. (PTC 23-2003)
bellows: a flexible pressure-containing component of a balance direct spring valve used to prevent changes in set pressure when the valve is subjected to a superimposed back pressure, or to prevent corrosion between the disk holder and guide. (PTC 25-2018)

bench testing: testing of a pressure-relief device on a test stand using an external pressure source with or without auxiliary lift device to determine some or all of its operating characteristics. (PTC 25-2014)

bias error: the true systematic or fixed error, which characterized every member of any set of measurements from the population. It is the constant component of the total measurement error. (PTC 51-2011)


bias error: see error, systematic. (PTC 47-2006, PTC 47.4-2015, PTC 70-2009)

binary word: the maximum number of bits treated as a unit and capable of being stored in one location. (PTC 19.22-2007)

bit: a contraction of the words “binary” and “digit”. (PTC 19.22-2007)

bivariate correction: a correction that is a function of two independent parameters. (PTC 6.2-2011, PTC 51-2011)

bone dry: drying a sample at 221°F (105°C) in a ventilated oven under controlled conditions until no further weight loss. (PTC 34-2017)

bulk density: see density. (PTC 34-2017)

bivariate correction: A correction that is a function of two independent parameters (PTC 6.2-2004)

blowdown: quantity of water drained from a steam generator in a nuclear plant, the steam drum(s) in a fossil-fuel boiler, or a wet FGD system for continuous removal of impurities and sludge. (PTC PM-2010)

blowdown: removal of water from an evaporator for the purpose of controlling the dissolved solids concentration. (PTC 4.4-2008)

blowdown: the difference between actual popping pressure of a pressure relief valve and actual resetting pressure expressed as a percentage of set pressure or in pressure units. (PTC 25-2018)

blowdown: water discharged from a system to control the concentration of minerals or other impurities, such as from an evaporative cooler or wet cooling tower. (PTC 51-2011)

blowdown pressure: the value of decreasing inlet static pressure at which no further discharge is detected at the outlet of a pressure relief valve after the valve has been subjected to a pressure equal to or above the popping pressure. (PTC 25-2018)

blowdown ring: see adjusting ring. (PTC 25-2018)

blowout: circulating water blown out of the tower that is wind induced. Also called windage. (PTC 23-2003)

body: a pressure-retaining or pressure-containing member of a pressure relief device that supports the parts of the valve assembly and has provision(s) for connecting to the primary and/or secondary pressure source(s). (PTC 25-2018)

boiler air in-leakage: uncontrolled infiltration of air into the boiler through the boiler enclosure. (PTC PM-2010)
boiler fuel efficiency: the ratio of energy output to energy input when input is defined as the total heat of combustion available from the fuel. (PTC PM-2010)

boiler gross efficiency: the ratio of energy output to energy input when input is defined as the total heat of combustion available from the fuel plus heat credits. (PTC PM-2010)

boiling water reactor plant: type of nuclear plant that utilizes heat in the reactor directly as the source of main steam for producing power in the main steam turbines. (PTC PM-2010)

bonnet: a component of a direct spring valve or of a pilot in a pilot-operated valve that supports the spring. It may or may not be pressure containing. (PTC 25-2018)

bore area: the minimum cross-sectional flow area of a nozzle. (PTC 25-2014, PTC 51-2011)

bore diameter: the minimum diameter of a nozzle. (PTC 25-2014, PTC 51-2011)

booster compressor: centrifugal compressor used to increase air pressure from gas turbine air compressor discharge to a pressure required by the gasification process. It is used mainly in air-blown gasification processes. (PTC 47-2006)

bottoming cycle: lower-temperature thermodynamic power cycle of a combined cycle system. (PTC 47-2006)

breakthrough: first appearance in the solution flowing from an ion exchange unit of unabsorbed ions similar to those that are depleting the activity of the resin bed. Breakthrough is an indication that regeneration of the resin is necessary. (PTC 31-2011)

breaking pin: the load-carrying element of a breaking pin nonreclosing pressure relief device. (PTC 25-2018)

breaking pin housing: a pressure-retaining component that supports the breaking pin in a nonreclosing pressure relief device. (PTC 25-2018)

breaking pressure: the value of inlet static pressure at which a breaking pin or shear pin device functions. (PTC 25-2018)

british thermal unit (Btu): a unit of heat energy equal to the heat needed to raise the temperature of a 1-lb mass of air-free water from 60°F to 61°F at a constant pressure of 1 standard atm; the mean Btu is equal to 1/180 of the heat needed to raise a 1-lb mass of air-free water from its freezing point to its boiling point at a constant pressure of 1 standard atm. (PTC 19.5-2004)

Btu (British thermal unit): amount of heat required to change the temperature of 1 lb of water by 1°F at sea level. A unit of energy, defined by the relationship of one Btu/lb being equal to 2.326 kJ/kg, exactly, and called the International Table Btu. One Btu is equal to 1055.05585262 joules. (PTC 47-2006)

buckling pin: the load-carrying element of a buckling device. (PTC 25-2018)

built-up back pressure: pressure existing at the outlet of a pressure relief device caused by the flow through that particular device into a discharge system. (PTC 25-2018)

burden (instrument transformer): load connected to the secondary winding of an instrument transformer that determines the active and reactive power at the secondary terminals. The burden is expressed either as total ohms impedance with the effective resistance and reactance components or as the total volt-amperes and power factor at the specified value of current or voltage and frequency. (PTC 19.6-2018)

burner auxiliary air: air introduced into the burner to facilitate the combustion process. (PTC 4.4-2008)

burst pressure: the value of inlet static pressure at which a rupture disk device functions. (PTC 25-2018)
bypass: a passage for a fluid, permitting a portion or all of the fluid to flow around certain heating surfaces through which it would normally pass. (PTC 4.4-2008)

bypass damper: a damper that is used to bypass GTE from the HRSG to atmosphere. (PTC 4.4-2008)

by-product: material generated by the removal of SO2 with the FGD system that has commercial value. (PTC 40-2017)

C

calibration: the process of comparing the response of an instrument to that of a standard instrument over some measurement range and adjusting the instrument to match the standard, if appropriate. (PTC 47.1-2017)

calibration: process of comparing the response of an instrument to a standard instrument over some measurement range and adjusting the instrument to match the standard, if appropriate. Data gathered during calibration may be used to establish correction or uncertainty factors. Alternately, for an instrument, the development of documentation that will show the difference between the Code and the instrument and the uncertainty of doing the comparison. (PTC 19.6-2018)

calcination: endothermic chemical reaction that takes place when carbon dioxide is released from calcium carbonate to form calcium oxide, or from magnesium carbonate to form magnesium oxide. (PTC 4-2013, PTC 4.3-2017, PTC 47-2006)

calcination: the endothermic chemical reaction that takes place when calcium carbonate (limestone) is heated to form calcium oxide, and carbon dioxide is released. (PTC 34-2017)

calcium carbonate (CaCO3) equivalents: preferred reporting form of ionic concentrations of impurities in water facilitating calculations because calcium carbonate has a molecular weight of 100 and concentrations can be totaled and balanced when in this form. (PTC 31-2011)

calcium-to-sulfur molar ratio (Ca/S): total moles of calcium in the sorbent feed divided by the total moles of sulfur in the fuel feed. (PTC 4-2013, PTC 4.3-2017, PTC 47-2006)

calcium utilization: the percent of calcium in the sorbent that reacts with sulfur dioxide (SO2) to form calcium sulfate (CaSO4). It is sometimes called “sorbent utilization.” (PTC 4-2013, PTC 4.3-2017)

calcium utilization: percent of calcium in the sorbent that reacts with sulfur in a gasifier to form calcium sulfate or calcium sulfide. It is sometimes called sorbent utilization. (PTC 47-2006)

calibration: the process of comparing the response of an instrument to a standard instrument over some measurement range and adjusting the instrument to match the standard, if appropriate. (PTC Template, PTC 4.3-2017, PTC 29-2005, PTC 30.1-2007, PTC 47.4-2015, PTC 50-2002, PTC 51-2011, PTC 70-2009)

calibration: the process of comparing the response of an instrument or measurement system with a standard instrument or measurement system over some measurement range and adjusting the instrument or measurement system to match the standard if appropriate. (PTC 11-2008, PTC 46-2015)

calibration: the process of comparing the response of an instrument to a standard instrument over some measurement range or against a recognized natural physical (intrinsic) constant and adjusting the instrument to match the standard, if appropriate. (PTC 22-2014)

calibration drift: a shift in the calibration characteristics. (PTC 46-2015, PTC 51-2011)

calibration, field: the process by which calibrations are performed under conditions that are less controlled than the laboratory calibrations with less rigorous measurement and test equipment than provided under a laboratory calibration. (PTC 22-2014)
calibration, laboratory: the process by which calibrations are performed under very controlled conditions with highly specialized measurement and test equipment that has been calibrated by approved sources and remains traceable to National Institute of Standards and Technology (NIST), a recognized international standard organization, or a recognized natural physical (intrinsic) constant through an unbroken comparisons having defined uncertainties. (PTC 22-2014)

calibration: the process of comparing the response of an instrument to that of a standard instrument over some measurement range. (PTC 19.1-2018)

calibration: the process of comparing the response of an instrument to a standard over some measurement range and recording the difference. (PTC 18-2011)

calibration: the process of comparing the response of an instrument to a reference standard over some measurement range. (PTC 19.22-2007)

calibration hierarchy: established pedigree for a measurement based on the chain of calibrations that links or traces a measuring instrument to a primary standard. (PTC 19.1-2018)

calibration uncertainty: the uncertainty attributed to instrument calibration practices including the instrument linearity, hysteresis, and repeatability along with the accuracy of the calibration equipment. (PTC 12.5-2000)

calorie: unit of energy, defined as equal to 4.1868 joules, exactly, and called the International Table calorie. (PTC 47-2006)

calorific value: see heating value, higher (gross calorific value) and heating value, lower (net calorific value). (PTC 34-2017)

calorie: the amount of heat energy required to raise the temperature of 1 g of pure water from 14.5°C to 15.5°C at a constant pressure of 1 standard atm. (PTC 19.5-2004)
cap: a component used to restrict access and/or protect the adjustment screw in a reclosing pressure relief device. It may or may not be a pressure containing part. (PTC 25-2018)
capacity: the amount of steam flow at the given steam temperature and pressure. (PTC 4.4-2008)
capacity: the maximum main steam mass flow rate the steam generator is capable of producing on a continuous basis with specified steam conditions and cycle configuration (including specified blowdown and auxiliary steam flow). This is frequently referred to as “maximum continuous rating.” (PTC 4-2013, PTC 4.3-2017)
capacity, maximum: maximum flow rate from an individual equipment item or grouping of equipment items that is capable of being produced on a continuous basis under specified conditions. This is also frequently referred to as maximum continuous rating (MCR). (PTC 47-2006)
capacity factor: ratio of the average load on a machine for a period of time relative to the rated capacity of the machine. (PTC PM-2010)
capacity of a steam trap: the amount of condensate per unit time which will be discharged continuously from the steam trap under specified conditions of pressure differential and inlet subcooling. Capacity is expressed in units of pounds mass per hour or kilograms per hour. (PTC 39-2005)
capacity (system) maximum continuous rating (MCR): the maximum steam flow the steam generator is designed to produce on a continuous basis at a specified steam pressure and temperature. (PTC 34-2017)
capacity, peak: the maximum main steam mass flow rate the steam generator is capable of producing with specified steam conditions and cycle configuration (including specified blowdown and auxiliary steam flow) for intermittent operation (i.e., for a specified period of time without affecting future operation of the unit).
capacity (system) peak: the maximum steam flow the steam generator is designed to produce for a specified period of time on a continuous basis at a specified steam pressure and temperature. (PTC 34-2017)

capacity (system) processing: the quantity (volumetric or gravimetric) of waste material that a system is designed to process in a specified time period under specified conditions. (PTC 34-2017)

capacity (system) rated: see MCR. (PTC 34-2017)

capacity, thermal: the heat input from fuel per unit time. (PTC 34-2017)

carbon conversion efficiency: indicator of the degree to which the fuel carbon compounds are converted to carbon-containing gaseous components. These gaseous components include CO, CO₂, CH₄, COS, and CₓHᵧ (CₓHᵧ includes organic gaseous compounds such as ethane, propane, butane, etc., and cyclic organic compounds such as benzene, etc.). Carbon conversion efficiency can also be determined as 1.00 minus carbon energy loss (the amount of energy in carbon compounds exiting the gasification systems as solid and liquid streams, divided by the fuel carbon energy input). (PTC 47-2006)

carryover: excess moisture that is not evaporated into the air stream. (PTC 51-2011)

cascading blowdown: a blowdown system wherein the water from a higher pressure level is blown down to lower pressure levels. (PTC 4.4-2008)

cation: positive charged ion, such as sodium (Na⁺), calcium (Ca⁺⁺), ammonia (NH₄⁺), magnesium (Mg⁺⁺), potassium (K⁺), barium (Ba⁺⁺), strontium (Sr⁺⁺), iron (Fe⁺⁺), manganese (Mn⁺⁺), copper (Cu⁺⁺), and aluminum (Al⁺⁺). (PTC 31-2011)

cation exchange material: ion exchange material capable of the reversible of positively charged ions. (PTC 31-2011)

cation exchange material, intermediate acid: ion exchange material containing a mixture of weakly acidic and strongly acidic groups. The properties of this resin are intermediate between the weak and strong acid cation exchangers. (PTC 31-2011)

cation exchange material, strong acid: ion exchange material containing the highly ionized sulfonic acid functional group (SO₃H). It can easily split salts converting them to acids. (PTC 31-2011)

cation exchange material, weak acid: ion exchange material containing the weakly ionized carboxylic acid group COOH, which has a great affinity for the hydrogen ion. When operating in the hydrogen (H⁺) form, it removes only that part of the total cations that is equivalent in amount to the bicarbonate alkalinity. When operating in the sodium (Na⁺) form following regeneration with acid followed by regeneration with caustic soda (sodium hydroxide), it removes only the hardness ions Ca⁺⁺ and Mg⁺⁺. (PTC 31-2011)

cations, total: numeric sum of the cations listed above with all being expressed as calcium carbonate (CaCO₃) equivalents. (PTC 31-2011)

cations, total exchangeable: numeric sum of only those cations listed above to be removed, with all being expressed as calcium carbonate (CaCO₃) equivalents. For example, in simple softening ion exchange, this would be the sum of only the hardness ions calcium and magnesium. This is also referred to as “total hardness.” However, any multivalent ion held stronger than sodium would also be removed. In naturally occurring waters these ions are usually very low in concentration relative to hardness levels and can normally be ignored. (PTC 31-2011)

cell: the smallest subdivision of a tower, bounded by exterior wall(s) and/or partition(s), which can function as an independent unit. (PTC 23-2003)

cellulose acetate: cellulose material used in a reverse osmosis membrane. (PTC 31-2011)
celsius: a thermometer invented in 1742 by Anders Celsius, a Swedish astronomer, who graduated the interval between the freezing point of water and its boiling point into 100° (wherefrom centigrade) at an atmospheric pressure of 760 mmHg. The present scale has the freezing point at 0°C and the boiling point at 100°C, just the reverse of the numbering by Celsius. (PTC 19.5-2004)

channel: a single path through a transmission media intended to carry the signal of an instrument reading. Typically, it carries the raw electrical signal of the instrument, or the output of a multiplexing function. (PTC 19.22-2007)

channeling: cleavage and furrowing of the bed due to faulty design and/or operational procedures, in which the solution being treated follows the path of least resistance, runs through these furrows, and fails to contact active groups in other parts of the bed. (PTC 31-2011)

colar: solid residue remaining after the removal of moisture, volatile matter, and possibly some fixed carbon from coal. (PTC 47-2006)

charge energy: the amount of primary energy crossing the test boundary during the charge interval. (PTC 53-2018)

charge interval: the time duration during which the charging process operates. (PTC 53-2018)

charge loss rate: the change of the state of charge during a standby interval, expressed as kilowatt-hours per hour. (PTC 53-2018)

charge power: the rate at which charge energy crosses the test boundary; the charge energy divided by the charge interval. (PTC 53-2018)

charge power rating: a charge power designated in a test plan (such as maximum, minimum, nominal, or guaranteed) that may be derived from contracts, specifications, nameplates, guarantees, or other sources. (PTC 53-2018)

charge process: the means by which primary energy is transformed into increased internal energy of the storage medium. (PTC 53-2018)

charge start-up interval: the time duration of transition from the standby state to the charge power rating. (PTC 53-2018)

chatter: abnormal rapid reciprocating motion of the movable parts of a pressure relief valve in which the disk contacts the seat. (PTC 25-2014)

checksum bit (check bit): a bit, such as a parity bit, derived from and appended to a bit string for later use in error detection and possibly error correction. (PTC 19.22-2007)

chemical absorption spectrophotometry: quantitative procedures devised to relate light absorption at a selected wavelength to the concentration of the species of interest in the optical path. (PTC 19.11-2008)

chiller: a device that uses a closed-loop refrigeration cycle where heat is exchanged with an external fluid after the refrigerant is expanded, resulting in a reduction in temperature of the external fluid. Typical refrigeration cycles include mechanical chilling where refrigerants (such as r13a) are compressed, condensed, expanded, and evaporated in a continuous loop similar to an air conditioner, or an absorption process using refrigerants (such as lithium bromide or ammonia). (PTC 51-2011)

circulating water flow: quantity of hot water flowing into the tower to be cooled. (PTC 23-2003, PTC 51-2011)

class 1 instrument: an instrument that is used to determine a class 1 primary parameter. (PTC 51-2011)

class 1 primary parameter: a primary parameter that has a relative sensitivity coefficient of 0.2% or greater. (PTC 51-2011)
class 1 primary variable: a primary variable that has a relative sensitivity coefficient of 0.2% or greater. (PTC 51-2011)

class 2 instrument: an instrument that is used to determine a class 2 primary parameter. (PTC 51-2011)

class 2 primary parameter: a primary parameter that has a relative sensitivity coefficient of less than 0.2%. (PTC 51-2011)

class 2 primary variable: a primary variable that has a relative sensitivity coefficient of less than 0.2%. (PTC 51-2011)

cleanliness factor: ratio of the actual thermal transmittance to the transmittance at 100% clean condition. (PTC PM-2010)

cleanliness factor: ratio of thermal transmittance of tubes to that of new or cleaned (to a like-new state) tubes operating under identical conditions. (PTC 12.2-2010)

clinker: large, solid mass of coal ash agglomerated by ash slagging. (PTC 47-2006)

clinker: hard, sintered, or fused pieces of residue formed in a furnace by the agglomeration of ash, and may contain char, metals, glass, and/or ceramics. (PTC 34-2017)

closing pressure: the value of decreasing inlet static pressure at which the valve disk reestablishes contact with the seat or at which lift becomes zero. (PTC 25-20014)

closed-looped heater/chiller system: a heating/chilling system in which the working fluid does not become entrained in the gas turbine inlet air stream. (PTC 51-2011)

CO catalyst: a catalyst that is used to reduce carbon monoxide level in the GTE. (PTC 4.4-2008)

coal rank: classification of coal based on fixed carbon, volatile matter, and heating value. It is an indication of the progressive alternation, or coalification, from lignite to anthracite: lignite, subbituminous coal, bituminous coal, and anthracite. (PTC 47-2006)

concurrent flow: direction of flow of the regenerate is the same direction of flow as the service flow. (PTC 31-2011)

co-current flow: the flow of two or more fluids following a similar path with adjacent inlet and outlet connections. (PTC 51-2011)

code limit: the combination of applicable uncertainty limits for each of the measured parameters for that particular configuration and test. (PTC 22-2014)

coefficient of discharge: the ratio of the measured relieving capacity to the theoretical relieving capacity. (PTC 25-2014, PTC 51-2011)

cogeneration plant: a cycle that produces both electric power and at least one secondary output for use in a process external to the test boundary. (PTC 46-2015)

cogeneration steam load: the portion of the steam generated in the unit that is diverted to a process unrelated to power generation. The diverted steam is not condensed in the ACC, and the condensate may or may not be returned to the condensate tank. (PTC 30.1-2007)

coke: in general, coke is made from bituminous coal (or blends of bituminous coal) from which the volatile constituents have been driven off by heat, so that the fixed carbon and ash are fused together. Coke is hard and porous. Petroleum coke is a similar material that is derived from oil refinery operations and usually contains high sulfur content. (PTC 47-2006)
**cold acid gas removal process:** acid gas removal process operating below ambient temperature, usually employing a physical solvent to react with the acid gases. (PTC 47-2006)

**cold box:** enclosure containing cryogenic equipment that is part of the ASU. (PTC 47-2006)

**cold differential test pressure:** the inlet static pressure at which a pressure relief valve is adjusted to open on the test stand. This test pressure includes corrections for service conditions of superimposed back pressure and/or temperature. (PTC 25-2014)

**cold leg temperature:** in a pressurized water reactor plant, the temperature of water exiting the steam generator and entering the reactor. (PTCPM-2010)

**cold stream:** flow stream with the lower heat exchanger inlet temperature. (PTC 12.5-2000)

**cold stream temperature change:** the difference between the outlet and inlet temperatures of the cold stream (PTC 12.5-2000)

**cold water temperature:** average temperature of water as it leaves the tower basin. (PTC 23-2003)

**colloids:** matter of very fine particle size, usually in the range of $10^{-5}$ cm to $10^{-7}$ cm in diameter. Colloids of iron and silica are frequently found in surface water, carry electrical charges, and cause fouling of reverse osmosis membranes and pass completely through ion exchange resin beds. (PTC 31-2011)

**color throw:** describes the phenomenon of processed effluent being colored more than the influent, generally caused by
(a) deterioration of ion exchange resin stored for prolonged periods at elevated temperatures
(b) deterioration of ion exchange resin due to repeated freezing and thawing
(c) high content of iron in raw water
(d) microbial contamination of raw water
(e) leaching into the effluent of residual monomers from the manufacturing process as a result of prolonged or repeated storage. (PTC 31-2011)

**combined cycle:** two sequential thermodynamic power conversion systems operating at different temperatures. For the purposes of this Code, a combined cycle plant is composed of a gas turbine cycle followed by a steam turbine cycle generally supplied by the hot exhaust energy of the gas turbine. (PTC 47-2006)

**combined cycle:** two sequential thermodynamic power conversion systems operating at different temperatures. This Code applies only to combined cycles consisting of Brayton and Rankine cycles. (PTC 47.4-2015)

**combined hierarchy:** root-sum-square combination of systematic and random standard uncertainties for a measurement or result. (PTC 19.1-2018)

**combustibles in ash:** see unburned carbon. (PTCPM-2010)

**combustion chamber:** enclosed space provided for the combustion of fuel. (PTC 4-2013, PTC 4.3-2017, PTC 47-2006)

**combustion efficiency:** a measure of the completeness of oxidation of all fuel compounds. It is usually quantified as the ratio of actual heat released by combustion to the maximum heat of combustion available. (PTC 4-2013, PTC 4.3-2017)

**combustion split:** the portion of energy released in the dense bed region of a fluidized bed expressed as a percentage of the total energy released. (PTC 4-2013)

**combustion split:** the portion of energy released in the dense bed region of a fluidized bed, expressed as a percentage of the total energy released. (PTC 4.3-2017)

**combustor:** a direct-fired air heater in which fuel is burned at near stoichiometric combustion with compressor
discharge air at constant pressure. Since the overall air/fuel ratio in the combustor is well above stoichiometric, the air must be introduced in stages or zones. The primary zone will typically use about 10% to 15% of the compressor discharge air to initiate combustion, the secondary zone will introduce additional air to complete the remaining air to arrive at a suitable turbine inlet temperature. (PTC 55-2013)

**combustor**: heat source consisting of chamber(s) in which fuel burns or otherwise reacts with its working fluid to increase the temperature. (PTC 47-2006)

**common header interconnection**: ion exchange unit interconnection method where all units of identical type or function are interconnected by a shared influent and effluent pipe header. (PTC 31-2011)

**comparative performance**: change in performance of the gas turbine power plant expressed as a differential or ratio. (PTC 22-2014)

**compressed regeneration schedule**: sequence designed to reduce total regeneration time by injecting dilute regenerant chemicals simultaneously into two or more dissimilar units. (PTC 31-2011)

**compressibility coefficient**: the ratio of the fan inlet density to the fan mean density. (PTC 11-2008)

**compressibility coefficient**: a dimensionless coefficient used to account for compressibility effects (PTC 11-2008)

**compressor**: mechanical rotary component that compresses a working fluid. (PTC 47-2006)

**compressor/fan**: a compressor or fan is a rotating device that pressurizes the working fluid prior to entry to a combustor or expansion through an exhaust nozzle. Axial and centrifugal configurations are typical. (PTC 55-2013)

**compressor inlet**: the plane containing the furthest upstream portion of inlet bell mouth of the compressor. (PTC 51-2011)

**compressor inlet temperature**: the dry-bulb temperature of the air at the compressor inlet measured at a point prior to the rapid acceleration/pressure drop as the airflow into the bell mouth. (PTC 51-2011)

**compensating mechanism**: includes those elements of the governor-control mechanism that modify the motion of the turbine-control mechanism to prevent over-travel, thus producing stability. Stability is obtained by modifying the input-error signal with a signal that is a function of the derivative(s) of speed. Derivative of speed should be determined:

(a) by direct electrical or mechanical measurement as used in the “derivative” or “accelero-tachometric” types, or

(b) by indirect measurement by means of a dashpot, or equivalent device in combination with the restoring connections as used in the “dashpot” or “temporary droop” types. (PTC 29-2005)

**composite air temperature**: the mass weighted average temperature of all the air streams either entering or leaving a multi-sector air heater. (PTC 4.3-2017)

**concentrate (brine, reject)**: waste liquid containing all the solids and material unable to pass through the membrane. (PTC 31-2011)

**condensate**: water coming from the condenser. (PTC 4.4-2008)

**condensate demineralizer**: ion exchange units applied to the removal of contaminants from steam condensates. Mixed-bed units are utilized for this application at much higher flow rates per square foot of resin bed surface than mixed-bed units employed for high solids water processing. (PTC 31-2011)

**condensate flow**: flow of water from the condenser hotwell through the low pressure heaters to the boiler feed pumps. (PTC PM-2010)

**condensate ion exchanger**: ion exchange equipment containing cation exchange resin in the sodium
condensate polisher: see condensate demineralizer and condensate ion exchanger. (PTC 31-2011)

condensate pump: a pump that withdraws condensate from the condensate tank and discharges it to the boiler circuit, HRSG, or other components of the power cycle. Also called condensate forwarding pump. It is typically not supplied nor tested as part of the ACC. (PTC 30.1-2007)

condensate tank: a vessel at roughly the same pressure (vacuum) as the ACC that collects condensate returning from the heat transfer surfaces, plant drains, and makeup water. It is typically supplied and tested as part of the ACC. (PTC 30.1-2007)

condenser: the vessel that is used to condense the steam exiting the steam turbine. (PTC 4.4-2008)

condenser air in-leakage: leakage of air into the condenser steam side. (PTC PM-2010)

condenser heat load: rate at which heat in steam is transferred to cooling water. This is usually considered the independent variable in any condenser test. (PTC 12.2-2010)

condenser pressure: the absolute pressure at the prescribed location, typically at or near the steam turbine exhaust flange at which design and guarantee performance are to be achieved. (PTC 30.1-2007)

condenser pressure: absolute pressure on the steam side of the condenser above the tube bundles. It is sometimes referred to as condenservacuum when referenced to atmospheric pressure. It may not be the same as turbine exhaust pressure. (PTC PM-2010)

condition-based maintenance (CBM): maintenance based on emerging failure, also known as on-condition, or condition-directed. (PTC PM-2010)

conditioning element: any physical device described in this Code that is used primarily for heating or cooling, and/or humidifying or dehumidifying the GT inlet air prior to entering the gas turbine. (PTC 51-2011)

conductivity (cation): amplified electrical conductance of a solution that has had all cations and amines present replaced by hydrogen (H+) ions by being passed through a highly regenerated column of hydrogen form strong cation exchange resin. (PTC 31-2011)

conductivity (degassed cation): cation conductance of a solution that has also been degasified to remove any contribution of carbon dioxide to the electrical conductance of the solution. (PTC 31-2011)

conductivity (specific): electrical conductance of a solution is a general property and is not specific for any particular ion. In determining the quality of the effluent from certain ion exchange processes, it is an excellent method of assessing total salt content. The value is reported in μS/cm² (μmho/cm²). (PTC 31-2011)

confidence level: a percentage value such that if a very large number of determinations of a variable are made, there is a percent probability that the true value will fall within the interval defined by the mean plus or minus the uncertainty. A value for uncertainty is meaningful only if it is associated with a specific confidence level. As used in this Code, all uncertainties are assumed to be at the 95% confidence level. If the number of determinations of a variable is large and the values are normally distributed, the uncertainty at the 95% confidence level is approximately twice the standard deviation of the mean of the values. (PTC 11-2008)

confidence level: the probability that the true value falls within the specified limits. (PTC 19.1-2018)

confidence level: the probability that the true value falls within the specified limits (expressed as percent). (PTC 34-2017)
**consistent liquid or gaseous fuels:** fuels with a heating value that varies less than one percent over the course of a performance test. (PTC 46-2015, PTC 50-2002)

**constant back pressure:** a superimposed back pressure which is constant with time. (PTC 25-2014)

**consumption, compressed air:** compressed air consumed by the FGD system. (PTC 40-2018)

**consumption, energy/power:** compilation of all energy/power inputs to the FGD system. (PTC 40-2018)

**consumption, water:** water added to the FGD system. (PTC 40-2018)

**contact resistance:** the resistance between the closed contacts of a relay in a multiplexer. (PTC 19.22-2007)

**continuous blowdown:** the uninterrupted removal of water from an evaporator section to control solids concentration. (PTC 4.4-2008)

**continuous monitoring:** monitoring conducted on a uniform continuous basis, using automated data collection. (PTC PM-2010)

**control range:** capacity range over which the gas turbine, steam turbine, and main steam temperature and/or reheat steam temperature can be maintained at the rated conditions. (PTC 47-2006)

**control range:** the capacity range over which main steam temperature and/or reheat steam temperature can be maintained at the rated conditions. (PTC 4-2013)

**control temperature:** temperature or schedule of temperatures determined by the manufacturer that defines one of the operating conditions for the test. This temperature may or may not coincide with temperature of the working fluid exiting the gas turbine. Regardless of measurement location, control temperature is internal to the test boundary. (PTC 22-2014, PTC 51-2011)

**controlled pressure inlet:** the steam turbine operating mode in which the steam turbine inlet control valves open or close to control the steam pressure. The result is a change in flow. This mode of operation has been called turbine follow. (PTC 6.2-2011)

**controlling guarantee case:** that combination of thermal duty, condensing pressure, and inlet air temperature that dictates the design of the ACC. (PTC 30.1-2007)

**cooling tower:** a semi-enclosed device for cooling water by direct contact with air. (PTC 23-2003, PTC 51-2011)

**cooling-water velocity:** average water velocity through tubes. For multipass condensers with an unequal number of tubes in the different passes, the average of the average velocities for all passes shall be used. (PTC 12.2-2010)

**copper:** may be soluble or a particulate oxide. (PTC 31-2011)

**corrected heat input:** the primary heat input entering the test boundary corrected to base reference conditions. (PTC 46-2015)

**corrected heat rate:** the test calculated heat rate corrected to base reference conditions. (PTC 46-2015)

**corrected performance:** performance parameter adjusted mathematically to specified reference conditions. (PTC 22-2014, PTC 30.1-2007, PTC 51-2011)

**correction factors:** factors to be applied to test results to correct for off-design or nonstandard conditions. (PTC PM-2010)
corrected power: the power leaving the test boundary at the test-specified operating conditions and corrected to the base reference conditions. (PTC 46-2015)

countercurrent flow: direction of flow of the regenerant is the reverse of the direction of flow of the service flow. (PTC 31-2011)

counterflow: the flow of fluids through a heat exchanger in which the two fluids flow in opposite directions. (PTC 51-2011)

counterflow tower: a type of tower in which the air and water streams flow in opposing directions. (PTC 23-2003, PTC 51-2011)

coverage: percentage of observations (measurements) of a parameter that can be expected to differ from the true value of the parameter by no more than the uncertainty. (PTC 4-2013, PTC 4.3-2017, PTC 47-2006)

cracking pressure: see opening pressure. (PTC 25-2014)

credits: energy entering the steam generator envelope other than the chemical energy in the as-fired fuel. These credits include sensible heat (a function of specific heat and temperature) in the fuel, entering air, and atomizing steam; energy from power conversion in the pulverizers, circulating pumps, primary air fans, and gas recirculation fans; and chemical reactions such as sulfation. Credits can be negative, such as when the air temperature is below the reference temperature. (PTC 4-2013)

credits: energy entering the defined envelope other than the chemical energy in the as-fired fuel. These credits include “sensible heat” (a function of specific heat and temperature) in the fuel, “sensible heat” as in the entering air, “sensible heat” as in the atomizing steam, as well as energy from power conversion in the pulverizer, circulating pumps, primary air dehydration, and gas recirculation fans. Credits can be negative, such as when the air temperature is below the reference temperature. (PTC 47-2006)

credits: energy entering the steam generator envelope other than the chemical energy in the as-fired fuels. These credits include "sensible heat" (a function of specific heat and temperature) in the entering air, "sensible heat" in the fuels, as well as energy from power conversion in the pumps, and fans. Credits can be negative such as when the air temperature is below the reference temperature. (PTC 4.3-2017)

cross-flow: the flow of fluids through a heat exchanger in which the two fluids flow perpendicular to each other. (PTC 51-2011)

crossflow filtration: membrane processes use flow of the liquid across (tangential to) the membrane surface. (PTC 31-2011)

crossflow tower: a type of tower in which the air and water streams are in crosscurrent (perpendicular) flow. (PTC 23-2003, PTC 51-2011)

crosstalk: the undesired signal appearing in one signal path as a result of coupling from another signal path. (PTC 19.22-2007)

crud: particulate metallic oxides present in condensate that are filtered out in condensate polishers and powdered resin filtration systems. (PTC 31-2011)

current transformer (CT): instrument transformer that is used to reduce a high current to a proportionately lower current that may be safely applied to a measuring instrument. (PTC 19.6-2018)

curtain area: the area of the cylindrical or conical discharge opening between the seating surfaces created by
cycle isolation or alignment: the procedure used to minimize unaccounted-for flows entering, leaving, or bypassing cycle components. (PTCPM-2010)

cyclone: equipment in which centrifugal forces are used to separate particulate matter from a gas stream. (PTC 47-2006)

\[ D \]

\[ D_{10}: \text{arithmetic mean diameter (AMD). The simple average diameter of all the droplets in a spray.} \]

\[ D_{10} = \frac{\sum n_i D_i}{\sum n_i} \]

\[ D_{20}: \text{surface area mean diameter (SMD). The SMD value characterizes the spray by giving the diameter of a hypothetical droplet that has a surface area equal to the average surface area of all the measured droplets.} \]

\[ D_{20} = \left( \frac{\sum n_i D_i^2}{\sum n_i} \right)^{1/2} \]

\[ D_{21}: \text{surface area-length (absorption) diameter. This diameter is calculated using the surface-to-diameter ratio. It is equal to the sum of the square of all the droplet diameters divided their straight sum.} \]

\[ D_{21} = \left( \frac{\sum n_i D_i^2}{\sum n_i D_i} \right) \]

\[ D_{30}: \text{volume mean diameter (VMD). The VMD value characterizes the spray by giving the diameter of a hypothetical droplet that has a volume equal to the average volume of all the measured droplets.} \]

\[ D_{30} = \left( \frac{\sum n_i D_i^3}{\sum n_i} \right)^{1/3} \]

\[ D_{31}: \text{volume length (evaporative) diameter (ED). This diameter is calculated using the volume-to-diameter ratio. It is equal to the sum of the cube of all the droplet diameters divided by their straight sum.} \]

\[ D_{31} = \left( \frac{\sum n_i D_i^3}{\sum n_i D_i} \right)^{1/2} \]

\[ D_{32}: \text{sauter mean diameter (SMD). This diameter is calculated using the volume-to-surface-area ratio. It is equal to the sum of the cube of all diameters divided by the sum of the square of all diameters. This yields a characteristic droplet diameter that has a volume-to-surface-area ratio equal to the volume-to-surface-area ratio of the entire spray. This diameter is particularly important in gas turbine evaporative fogging system applications because the mass transfer happens at the interface of the droplets and the surrounding air (i.e., at the droplet surface). To enhance the evaporation of a population of droplets, one has to maximize the active surface areas and minimize the internal volumes.} \]

\[ D_{32} = \left( \frac{\sum n_i D_i^3}{\sum n_i D_i^2} \right) \]

damping time constant: time constant of the integral action of the governor, defined by the slope of the governor step response curve with \( b_p = K_p = K_D = 0 \), and input signal \( x = 1 \). (PTC 29-2005)

dashpot reset time: for mechanical governors, the decay time constant for the temporary droop feedback. (PTC 29-2005)

data acquisition system: any device or collection of devices capable of accepting information, converting this
information to corresponding digital information, applying prescribed processes to the information, and supplying the results of the processes. (PTC 19.22-2007)

data acquisition system: a system by which substantially all of the test measurements are acquired and recorded electronically and stored directly in a computer. (PTC 30.1-2007)

data compression: the method of filtering data, by exception or other means, and storing it only if meeting specified criteria. The primary function of this method is to optimize data storage space by limiting the amount of data being stored. (PTC 19.22-2007)

data reduction: the method by which raw test data being collected by the data acquisition system is summarized through simple calculations to produce more meaningful information. (PTC 19.22-2007)

data validation: process to ensure that the collected data satisfies statistical criteria and complies with the physical laws (thermodynamics, fluid dynamics, etc.) of the process. (PTC PM-2010)

deadband: the maximum band between two values inside of which the variation of controlled variable does not cause any governing action. This term can be applied to controlled variables such as speed, power or level (PTC 29-2005)

dead end: term applied to cartridge and membrane filtration to signify flow path perpendicular to the surface of the filtration medium. (PTC 31-2011)

deadtime: time interval between a specified type of change in input signal and the first detectable movement of the servomotor that results from this change. (PTC 29-2005)

daerator: a device that removes dissolved oxygen from the makeup water. (PTC 30.1-2007)

daeration: removal of oxygen and other dissolved gases from the water. (PTC 4.4-2008)

daerator: the pressure vessel wherein the dissolved gases are removed from water (PTC 4.4-2008)

dealkalizer: application of acid regenerated cation or chloride regenerated anion ion exchanger resins in equipment designed to reduce alkalinity in waters. (PTC 31-2011)

dealkalizer (split stream): a system of dealkalization that blends acidic and alkaline waters to achieve a desired effluent alkalinity. (PTC 31-2011)

decarbonator (force-draft): process equipment in water treatment installations used to reduce or remove free carbon dioxide from the water passed through it by contact between water and stripping gas, usually air. (PTC 31-2011)

decibel (dB): unit of the level, $L$, of a power or power-like quantity when the base of the logarithm is 10.

$$L = 10 \log_{10}(Q / Q_0), \text{dB}$$

where

$Q =$ is the power-like quantity concerned

$Q_0 =$ is the corresponding reference value

degasifier (vacuum): process equipment in demineralizer installations used to reduce or remove the free carbon dioxide and air content from the water passed through it by subjecting the water to a vacuum. (PTC 31-2011)

degrees of freedom ($\nu$): the number of independent observations used to calculate a statistic. (PTC 19.1-2018)
dehydration: endothermic chemical reaction that takes place when water is released from calcium hydroxide to form calcium oxide, or from magnesium hydroxide to form magnesium oxide. (PTC 4-2013, PTC 47-2006, PTC 4.3-2017)

demineralization: the removal of all dissolved ions from water. (PTC 31-2011)

density, \( \rho \): mass per unit volume of a fluid. The density can be given static and total values in a fashion similar to pressure and temperature. If the gas is at rest, static and total densities are equal. (PTC 11-2008)

density, absolute: the weight of a unit volume of a material without voids at a stated temperature. (PTC 34-2017)

density, bulk: the weight of a unit loose or unpacked volume of a material including voids at a stated temperature. (PTC 34-2017)

density: ratio of mass to volume of a fluid or solid (PTC 12.2-2010)

derivative filter time constant: the filter time constant applied to the derivative gain term in order to reduce the derivative response to high noise frequencies. The derivative filter may comprise either one or two stages of filtration. (PTC 29-2005)

derivative gain: the ratio of the relative servomotor position change resulting from the rate of change of relative speed with \( b_p = K_i = K_p = 0 \). (PTC 29-2005)

design conditions: performance conditions upon which the design of the heat exchanger was based. (PTC 12.5-2000)

design conditions: see specified conditions. (PTC 4.3-2017)

design values: performance conditions upon which the design of the ACC is based and for which the performance of the ACC may be predicted. (PTC 30.1-2007)

desulfurizer: vessel where sulfur gases are removed from the syngas by means of a sorbent. (PTC 47-2006)

desuperheater: apparatus for reducing and controlling the temperature of a superheated vapor (attemperator). (PTC 4-2013, PTC 47-2006)

desuperheater: a mixing chamber wherein higher temperature steam is mixed with a lower temperature steam or water to decrease the overall steam temperature. (PTC 4.4-2008)

desuperheater: apparatus for reducing and controlling the temperature of a superheated vapor. (PTC 34-2017)

desuperheating: reduction of steam temperature by mixing the superheated steam with either water or lower temperature steam. (PTC 4.4-2008)

desuperheating flow: feedwater used to control the final temperatures of the main and reheat steam flows. (PTC PM-2010)

developed lift: the actual travel of the disk from closed position to the position reached when the valve is at flow-rating pressure. (PTC 25-2014)

diaphragm: a flexible metallic, plastic, or elastomer pressure-containing member of a reclosing pressure relief device used to sense pressure or to provide opening or closing force. (PTC 25-2018)

barometric pressure, \( p_b \): the absolute pressure exerted by the atmosphere. (PTC 11-2008)
differential: difference between two measured values. (PTC 12.2-2010)

differential pressure: differential pressure across the orifice plate in a water gauge. (PTC 12.2-2010)

differential pressure, $\Delta p$: the difference between any two pressures. (PTC 11-2008)

differential pressure: the difference between the inlet pressure and the discharge pressure. (PTC 39-2005)

differential pressure: the difference between the inlet pressure and the discharge pressure. Alternatively, the difference between two pressure zones, i.e., upstream and downstream of evaporative cooling media in the GT inlet. (PTC 51-2011)

digital signal: data represented by discrete values or conditions. (PTC 19.22-2007)

dilute phase: the portion of the bed in a circulating fluidized bed combustion chamber above the secondary air inlet ducts (made up primarily of the circulating particulate material). (PTC 4-2013, PTC 4.3-2017)

dilute phase: portion of the bed in a circulating fluidized bed gasification chamber above the secondary air inlet ducts (made up primarily of the circulating particulate material). (PTC 47-2006)

dimensionless groups: the various dimensionless quantities that appear in the Code. Any consistent system of units may be employed to evaluate these quantities unless a numerical factor is included, in which case units shall be as specified. (PTC 51-2011)

direct evaporative cooler: an evaporative cooler that adds moisture to the inlet air stream. (PTC 51-2011)

discharge area: see actual discharge area. (PTC 25-2018)

discharge pressure: the gage pressure measured at steam trap outlet. (PTC 39-2005)

discharge depth: a fraction or percentage equal to 1 minus the minimum state of charge at which the ESS can operate, which may be qualified as maximum, rated, normal, or guaranteed, and/or be referenced to the discharge power rating. (PTC 53-2018)

discharge energy: the amount of primary energy crossing the test boundary during a discharge interval. (PTC 53-2018)

discharge interval: the time duration during which the discharge process operates. (PTC 53-2018)

discharge power: the rate at which discharge energy crosses the test boundary; the discharge energy divided by the discharge interval. (PTC 53-2018)

discharge power rating: a discharge power indicated in a test plan (maximum, minimum, nominal, guaranteed, etc.), which may be derived from contracts, specifications, nameplates, guarantees, or other sources. (PTC 53-2018)

discharge process: the means by which internal energy of the storage medium is decreased and transformed into primary energy. (PTC 53-2018)

discharge start-up interval: the time duration of the transition from the standby state to the discharge power rating. (PTC 53-2018)

discrete frequency: a sound wave, the instantaneous sound pressure of which is a simple sinusoidal function of time. (PTC 36-2018)

disk: a moveable component of a pressure relief device that contains the primary pressure when it rests against the nozzle. (PTC 25-2018)
disk holder: a moveable component in a pressure relief device that contains the disk. (PTC 25-2018)

disposition: the arrangement of plant hardware and software to align the operation of the plant to support the goal of the performance test. (PTC 46-2015)

dissolved oxygen: Amount of oxygen dissolved in condensate (PTC 12.2-2010)

distributing valve: the element of the hydraulic-control mechanism that controls the flow of hydraulic fluid to the turbine-control servomotor(s). (PTC 29-2005)

distribution system: a system of conduits, orifices, weirs, or nozzles for receiving the circulating water entering the tower and distributing it over the fill or heat transfer plan area where it is in contact with air. (PTC 23-2003)

distributor (inlet): mechanical system in conventional ion exchange unit, generally located at the top of an exchanger, through which the influent enters the vessel for processing. When located at the top of a vessel, it may also act as a collector of the backwash water that is discharged to waste. In addition, it serves to prevent disturbance of the top of the resin bed due to impingement by introducing the influent evenly over the surface of the resin bed. (PTC 31-2011)

distributor (interface, mid-collector, or buried collector): used primarily in mixed-bed demineralizers. As implied, located at the interface between the beds of cation and anion resins that is formed after the backwash separates and classifies the two resins; collets the spent alkali and acid that has passed through the cation and anion resin layers; can be also used for distributing acid if it is to be passed downward through the cation resin bed and usually consists of a header and laterals, equipped with screens or strainers to retain resin, similar in design to the regenerant distributor. This type of distributor may also be used in other types of ion exchange equipment, such as stratified-bed units. (PTC 31-2011)

distributor (outlet or underdrain): mechanical system generally located at the bottom of an exchanger through which the processed liquid (effluent) is collected from the resin bed on a uniform basis with respect to the entire cross section of the exchanger. When located at the bottom of a vessel, it may also serve as the distributor for resin backwash water and resin mixing air. (PTC 31-2011)

distributor (regenerant): mechanical system through which the regenerant solution is introduced uniformly to the entire cross section of the exchanger for the maximum utilization of the regenerant solutions. (PTC 31-2011)

distributor (subsurface): mechanical system commonly used in cation condensate polishers, under the surface of a bed of resin or media, through which backwash solution is introduced uniformly to the entire cross section of the exchanger to loosen and remove particulates from the upper portion of the resin and to reduce bed differential pressure. (PTC 31-2011)

dome: the volume on the side of the unbalanced moving member opposite the nozzle in the main relieving valve of a pilot-operated pressure relief device. (PTC 25-2018)

double precision: use of two digital words together to increase the resolution of a digital signal that could not be represented by a single digital word. (PTC 19.22-2007)

drift: a change in system output over time independent of the input signal. (PTC 19.22-2007)

drift: circulating water lost from the tower in the form of fine droplets entrained in the exhaust air. (PTC 23-2003)

drift eliminator: devices(s) to minimize drift. (PTC 23-2003)

droop: a characteristic that defines the relationship between two controlled variables. It is the ratio of relative change of one variable and the resulting relative change of the second variable. See also speed droop and power droop. (PTC 29-2005)
**droplet size**: the physical size of water droplets in the inlet air stream. These are generally measured in units of microns using one or more of the diameter scales and reference test methods contained within this Code. (Note that for nozzle performance criteria, it is unacceptable to report droplet diameter in microns only; the reference scale and test method shall also be stated.)

\[ D_{0.01} = D_{0.10} \]: this is a representative diameter where 10% of the total volume of the liquid sprayed is in droplets with diameters smaller than or equal to the stated value.

\[ D_{0.05} \text{ (or } D_{0.50} \text{)}: \text{ mass median diameter (MMD). This is the same as the volume median diameter (VMD). This is the representative diameter where 50% of the total volume of the liquid sprayed is in droplets with diameters larger than the stated value and 50% is in droplets with diameters smaller than the stated value.} \]

\[ D_{0.90} \text{ (or } D_{0.90} \text{)}: \text{ This is the representative diameter where 90% of the total volume of the liquid sprayed is in droplets with diameters smaller than or equal to the stated value.} \] (PTC 51-2011)

dry ash gasifier: type of gasifier in which the ash leaves as either agglomerated or nonagglomerated solids, rather than as a molten slag. For example, the Tampella and KRW gasifiers are agglomerating types, but the ash exiting the gasifier is dry and not molten slag. (PTC 47-2006)

dry-bulb temperature, \( t_d \): the temperature measured by a dry thermometer or other dry sensor. (PTC 11-2008)

duct burner: an in-duct burner system used for auxiliary or supplementary firing. (PTC 4.4-2008)

dynamic blowdown: the difference between the set pressure and closing pressure of a pressure relief valve when it is over pressured to the flow-rating pressure. (PTC 25-2018)

**E**

economizer: a heat recovery device designed to transfer heat from the products of combustion to boiler feedwater. (PTC 34-2017)

efficiency: effectiveness of the operational performance of an ion exchanger. Efficiency in the adsorption of ions is expressed as the quantity of regenerant required to affect the removal of a specific unit weight of adsorbed material (e.g., pounds of acid per kilogram of salt removed). (PTC 31-2011)

efficiency: the electrical power output divided by the thermal heat input. When there are secondary heat inputs or outputs, such as steam for the process generated by a cogeneration power plant, the efficiency is expressed at specified reference values of those secondary heat flows. (PTC 46-2015)

efficiency, fuel: the ratio of the output to the input as chemical energy of fuel. (PTC 4-2013, PTC 4.3-2017)

efficiency, fuel: the ratio of the output to the input of the chemical energy in the or of fuel. (PTC 34-2017)

efficiency, gross: the ratio of the output to the total energy entering the steam generator envelope. (PTC 4-2013, PTC 4.3-2017, PTC 34-2017)

efficiency, thermal: see efficiency, fuel, and efficiency, gross. (PTC 34-2017)

effective discharge area: a nominal or computed area of flow through a pressure relief valve, differing from the actual discharge area, for use in recognized flow formulas to determine the capacity of a pressure relief valve. (PTC 25-2014)

effective mean temperature difference: the log mean temperature difference corrected for deviations from true countercurrent flow conditions. (PTC 12.5-2000)

effective outside tube surface area: total active external area of all tubes in condenser, including external air cooler if used. Active area excludes any tubes that may be plugged at time of test. (PTC 12.2-2010)

effective seat area: a computed area for use in calculating the set pressure of a given pressure relief valve when tested using an auxiliary lift-assist device. (PTC 25-2014)
effluent: liquid, solid, or gaseous product discharged or emerging from a process; in this Code, treated water discharged from an ion exchange system. (PTC 31-2011)

effluent: stream exiting the FGD system, whether solid, liquid, or gas (except treated flue gas). (PTC 40-2018)

electric efficiency: the ratio of the electrical energy output to the energy supplied to the power system expressed as a percentage. It is inversely related to heat rate. (PTC 50-2002, PTC 51-2011)

electrical conductivity: the reciprocal of the resistance in ohms measured between opposite faces of a centimeter cube of an aqueous solution at a specified temperature. (PTC 19.11-2008)

electrodeionization (EDI): membrane process that combines electrodialysis (ED) with self-regenerating ion exchange resins installed between the membranes. (PTC 31-2011)

electrodialysis (ED): membrane process that discriminates between particles on the basis of their electrical charge by preventing the substance to be concentrated from passing through the membrane. (PTC 31-2011)

electrodialysis reversal (EDR): modification ED in which the electrical field is periodically reversed to reduce material buildup. (PTC 31-2011)

electrodialysis stack: device that holds an array of membranes between two electrodes in such a way that the solutions being processed are separated. (PTC 31-2011)

electronic governor: a governing system that uses an electronic means of sensing and processing the input signal to the governor. This can be an analog circuit or a digital device. (PTC 29-2005)

elemental random error source: an identifiable source of random error that is a subcomponent of total random error. (PTC 19.1-2018)

elemental random standard uncertainty: an estimate of the standard deviation of the mean of an elemental random error source. (PTC 19.1-2018)

elemental systematic error source: an identifiable source of systematic error that is a subcomponent of the total systematic error. (PTC 19.1-2018)

elemental systematic standard uncertainty: an estimate of standard deviation of an elemental systematic error source. (PTC 19.1-2018)

elevated pressure air separation unit: air separation process that operates at air feed pressures above the level required to produce oxygen and nitrogen products at near atmospheric pressures. (PTC 47-2006)

emission rate (ESO2): mass rate at which SO2 is emitted. (PTC 40-2018)

emissions: emissions are any discharges from the plant. These may include gaseous, particulate, thermal, or noise discharges to the ambient air, waterways, or ground. They may be monitored for regulatory or other requirements. (PTC 46-2015)

emissions: nuisance discharges from power plant systems which are regulated by authorities having jurisdiction, such as air pollutants, waste streams and noise. (PTC 50-2002, PTC 51-2011)

emissions: air, solids, and water discharges from power plant systems or noise from power plant systems that are regulated by authorities having jurisdiction, such as air pollutants, waste streams, and noise. (PTC 70-2009)

empirical formulation: a representative equation to determine the discharge coefficient for a flow meter developed via theory and experience without application of meter-specific calibration data. (PTC 6.2-2011, PTC 51-2011)
endpoint: point of the service run of an ion exchange unit where salt, acid, or base leakage is sufficiently high to render the processed water unsuitable for a specific use. Determination of this value may be by conductivity, pH, or other measurements, and action required will generally be removed the unit or system from service at this point. (PTC 31-2011)

energy (expressed in watt-hours (Wh)): integral of active power with respect to time. One watt of power delivered continuously for 1 h delivers 1 Wh of energy. (PTC 19.6-2018)

energy balance method: sometimes called the “heat balance method.” A method of determining steam generator efficiency by a detailed accounting of all energy entering and leaving the steam generator envelope. (PTC 4-2013, PTC 4.3-2017, PTC 34-2017)

ergy balance method: method of determining equipment efficiency by a detailed accounting of all energy entering and leaving the equipment envelope; sometimes called the heat balance method. (PTC 47-2006)

energy loss: the amount of energy leaving the test boundary from the storage container, which decreases the internal energy of the storage medium. (PTC 53-2018)

energy relationships: the steady-state microscopic one-dimensional conservation of energy equation (along a streamline in an inviscid, irrotational steady flow) where the subscript number denotes a position and corresponding fluid state. One form of the equation applies to the steady flow of a frictionless fluid with no mechanical work performed on or by the surroundings, uniform velocities, and a constant gravitational acceleration. This reduces to the special case of an incompressible fluid, eq. to the Bernoulli equation. In manometry, the fluid is static and the kinetic energy term vanishes. In a flowing fluid, an increase in the velocity head involves a corresponding decrease in either elevation head, the static-pressure head, or both. Thus, after a flow-area contraction, the velocity head is necessarily increased to accommodate the constant mass flow, and consequently the static pressure is reduced. After a flow expansion at subsonic flow velocities, the static pressure is increased. In each case, the total pressure is the same before and after the area change, except for frictional losses, which would increase temperature and internal energy at the expense of mechanical energy. (PTC 19.2-2010).

energy storage system (ESS): a system that consumes primary energy to increase the internal energy of a storage medium and releases the stored energy at a later time as primary energy. (PTC 53-2018)

entering wet-bulb temperature: wet-bulb temperature of air temperature entering the tower; includes any effect of re-circulation and/or interference. (PTC 23-2003, PTC 51-2011)

enthalpy-drop test: a test conducted to determine the turbine efficiency based on the energy removed by a turbine section. (PTC PM-2010)

entrained flow gasifier: type of gasifier that is characterized by cocurrent flow of the hydrocarbon feed and oxidizing medium. Flow may be either upward or downward. (PTC 47-2006)

entrainment: suspension of liquid droplets in the flue gas stream. (PTC 40-2017)

entropy diagram: a diagram expressing entropy values corresponding to various locations in a heat balance diagram. (PTC PM-2010)

equivalents per liter (eq/L): concentration of ion equivalent that can be removed per liter of solution. An equivalent is the molecular weight in grams of the compound divided by its electrical charge or valence. For example, a resin with an exchange capacity of 1 eq/L could remove 37.5 g of divalent zinc (Zn$^{2+}$, molecular weight of 65) from solution. Since 1 eq/L is equal to 21.8 kg/ft$^3$, equivalents per liter can be converted to kilograins per cubic foot by multiplying by 21.8. (PTC 31-2011)

error: the difference between the true value and the measured value. The error includes bias (systematic) and precision (random) errors. (PTC 47.4-2015, PTC 55-2013)

error: the difference between the observed value and its corresponding true value. (PTC 19.1-2018)

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error: the difference between the true value of a quantity and the measured value. The true value of an error cannot be determined. (PTC 11-2008)

error (measurement, elemental, random, systematic): refer to ASME PTC 19.1 for definition. (PTC 46-2015)

error, bias: see systematic error. (PTC 34-2017)

error, random: sometimes called “precision error”, random error is a statistical quantity that is expected to be normally distributed. Random error results from the fact that repeated measurements of the same quantity by the same measuring system operated by the same personnel do not yield identical values. (PTC 4-2013, PTC 4.3-2017, PTC 47-2006)

error, systematic: sometimes called bias error, systematic error is the difference between the average of the total population and the true value. It is the true systematic or fixed error that characterizes every member of any set of measurements from the population, the constant component of the total error. (PTC 47.4-2015)

error, precision; see random error. (PTC 34-2017)

error, systematic: sometimes called “bias error”. The difference between the average of the total population and the true value. The true systematic or fixed error, which characterizes every member of any set of measurements from the population. (PTC 4-2013, PTC 4.3-2017, PTC 47-2006)

error, total: sum of systematic error and random error. (PTC 4-2013, PTC 4.3-2017)

error, total: difference between the true value and the measured value; includes both the random and systematic errors. (PTC 47-2006)

evaporation: water evaporated from the circulating water into the atmosphere during the cooling process. It is independent of drift. (PTC 23-2003, PTC 51-2011)

evaporative effectiveness: the ratio of temperature drop across an evaporative cooler to the potential amount of cooling \((T_{db} - T_{wb})\), expressed as percentage. (PTC 51-2011)

evaporator: a heat transfer section wherein feedwater is vaporized. (PTC 4.4-2008)

excess air: the amount of air in excess of the stoichiometric requirements. (PTC PM-2010)

excess oxygen: the percentage of oxygen present in the products of combustion. This is often confused with the term excess air. The terms represent different quantities and their values are not equal but are related. (PTC PM-2010)

exchanger: pressure vessel containing ion exchange material through which liquid to be processed is passed. In some process applications, the exchanger may contain mixtures of cation and anion resins, or even mixtures of different cation or anion resins, such as stratified-bed units. (PTC 31-2011)

exhaust air: the mixture of dry air and water vapor leaving the tower. (PTC 23-2003)

exhaust ejector: a nozzle that helps evacuate jet engine exhaust from an indoor test cell. (PTC 55-2013)

exhaust energy: the amount of nonprimary energy leaving the test boundary of the ESS during the charge interval or discharge interval. (PTC 53-2018)

exhaust gas emissions: constituents of the working fluid exiting the gas turbine that may be used to define in part the operating conditions for the test. (PTC 22-2014)

exhaust gas energy: energy of the working fluid exiting the gas turbine at a point defined by the test boundary. (PTC 22-2014)
exhaust gas flow: flow of working fluid exiting the gas turbine at a point defined by the test boundary. (PTC 22-2014)

exhaust gas temperature: mass weighted average temperature of working fluid exiting the gas turbine at a point defined by the test boundary. (PTC 22-2014)

exhaust loss: those losses associated with the steam exiting the low pressure turbine as a result of kinetic energy changes and pressure drops. They are usually characterized in the thermal kit provided by the turbine manufacturer. (PTC PM-2010)

exhaust nozzle: a component that converts gas turbine exit pressure, temperature, and flow into thrust by increasing the momentum of the gas stream. (PTC 55-2013)

exhaustion: state in which the resin is no longer capable of useful ion exchange; the depletion of the exchanger’s supply of available ions. The exhaustion point is determined arbitrarily in terms of (a) value in parts per million of ions in the effluent solution (b) the reduction in quality of the effluent water determined by a conductivity bridge that measures the electrical resistance of the water, or any other suitable criteria such as leakage of radionuclides. (PTC 31-2011)

exit air temperature: the temperature of the air leaving the ACC. (PTC 30.1-2007)

exit basin temperature: temperature of circulating water as it leaves the coldwater-collecting basin. (PTC 23-2003)

exit gas temperature: the average temperature of the flue gas leaving the steam generator boundary. This temperature may or may not be adjusted for air heater leakage. (PTC 4-2013, PTC 4.3-2017)

expanded uncertainty: an estimate of the limits of total error, with a defined level of confidence, (usually 95%). (PTC 19.1-2018)

expansion line: the locus of points on a Mollier diagram that depicts the thermodynamic states of the steam as it expands through the turbine. (PTC PM-2010)

external regeneration: procedure in which the ion exchange resin is sluiced or transferred (hydraulically, pneumatically, or by gravity) after exhaustion into another vessel wherein regeneration occurs. (PTC 31-2011)

extraction air: a defined air stream that intentionally leaves the test boundary. (PTC 22-2014, PTC 51-2011)

Fahrenheit: the scale used by Daniel Gabriel Fahrenheit, who invented a thermometer containing alcohol in 1709 and a mercury thermometer in 1714. The zero point on the scale was established by mixing equal quantities by weight of snow and common salt. The freezing point of water was found to be at 32° of graduation and the boiling point very near 212° under standard atmospheric pressure. (PTC 19.5-2004)

fan boundaries: Defined as the interface between the fan and the remainder of the system. These boundaries may differ slightly from fan to fan. The fan accepts power at its input power boundary and moves a quantity of gas from its inlet boundary to its outlet boundary and in the process increases the specific energy and pressure of this gas. The inlet boundary may be specified to include inlet boxes, silencers, rain hoods, or debris screens as a part of the fan. The outlet boundary may be specified to include dampers or a diffuser as a part of the fan. The input power boundary may be specified to include the fan-to-motor coupling or a speed reducer as part of the fan. (PTC 11-2008)

fan deck: the horizontal platform or barrier at or near the elevated plane of the fans. It may or may not provide for personnel access. (PTC 30.1-2007)
fan efficiency: the ratio of the fan output power to the fan input power. In this approach, there is only one definition of fan output power, so there is only one definition of fan efficiency. (PTC 11-2008)

fan gas density: the total density of the gas at fan inlet conditions. (PTC 11-2008)

fan input power: the power required to drive the fan and any elements in the drive train that are considered to be within the fan boundaries. (PTC 11-2008)

fan mass flow rate: the mass of fluid passing through the fan per unit time. (PTC 11-2008)

fan mean density: the ratio of the pressure change across the fan to the thermodynamic path integral of the differential of the pressure divided by the density. In this approach mean density is approximated by the arithmetic mean of inlet and outlet densities. (PTC 11-2008)

fan operating conditions: specified by the speed of rotation of the fan and sufficient information to determine the average gas properties, including pressure, temperature, density, viscosity, gas constants, and specific heats at the fan inlet. (PTC 11-2008)

fan output power: the product of fan mass flow rate and fan specific energy. Since mass flow rate equals the product of volume flow rate and density at a particular plane, fan output power can also be expressed as the product of fan inlet density, fan inlet volume flow rate, and fan specific energy. (PTC 11-2008)

fan output power: the product of fan volume flow rate, fan total pressure, and compressibility coefficient. (PTC 11-2008)

fan performance: may be expressed in terms of different sets of parameters. This Code provides the user with two choices. One set uses mass flow rate and specific energy. The other uses volume flow rate and pressure. The product of mass flow rate and specific energy and the product of volume flow rate, pressure, and a compressibility coefficient are each designated fan output power. However, values of output power calculated by the two methods are slightly different. (PTC 11-2008)

fan pitch: the angle of attack to which the fan blades are set, typically measured from the horizontal fan plane to the inclined chord of the fan blade at a designated measurement location on the fan blade. (PTC 30.1-2007)

fan specific energy: the work per unit mass that would be done on the gas in an ideal (frictionless) transition between the actual inlet and outlet states. The ideal work done on a unit mass of fluid is equal to the integral of the static pressure differential divided by the fluid density for the fan flow process plus changes of specific kinetic energy and specific potential energy across the fan. The fan specific energy is the average of the ideal work for all fluid particles passing through the fan. Only the component of velocity in the nominal direction of flow shall be taken into account when determining the specific kinetic energy. It is customary to assume that changes in potential energy are negligible in fans. For an incompressible flow process, the product of fan specific energy and fluid density is equal to the fan total pressure. For a non-constant density process, fan specific energy can be approximated by assuming some thermodynamic process within the fan in order to perform the pressure-density integration. (PTC 11-2008)

fan speed: the number of revolutions of the fan per unit time. (PTC 30.1-2007)

fan static efficiency: the ratio of fan output power to fan input power, in which the fan output power is modified by deleting the fan velocity pressure. This may also be called total-to-static efficiency. (PTC 11-2008)

fan static pressure: the difference between the fan total pressure and the fan velocity pressure. Therefore, fan static pressure is the difference between the average static pressure at the fan outlet, and the average total pressure at the fan inlet. (PTC 11-2008)

fan total efficiency, \( \eta_f \): the ratio of fan output power to fan input power. This may also be called total-to-total efficiency. (PTC 11-2008)
fan total pressure: the difference between the average total pressure at the fan outlet and the average total pressure at the fan inlet. Only the component of velocity in the nominal direction of flow shall be taken into account when determining fan total pressure. It is customary to assume that pressure changes due to elevation changes are negligible in fans. (PTC 11-2008)

fan velocity pressure: the product of the average density and average specific kinetic energy at the fan outlet. (PTC 11-2008)

fan volume flow rate: the fan mass flow rate divided by the fan gas density. (PTC 11-2008)

far field: the region not included in the near field. (PTC 36-2018)

feedwater: water entering an evaporator or economizer section. (PTC 4.4-2008)

feedwater flow: flow of water from the boiler feed pumps through the high pressure heaters to the boiler. (PTC PM-2010)

feedwater heater: see preheater. (PTC 4.4-2008)

feedwater heater drain cooler approach (DCA): the difference between the shell side drain outlet and the tube side inlet temperatures. (PTC PM-2010)

field calibration: the process by which calibrations are performed under less controlled conditions and using less rigorous measurement and test equipment than that provided under a laboratory calibration. (PTC 46-2015, PTC 51-2011)

field test: a device for in-service or bench testing of a pilot-operated pressure relief device to measure the set pressure. (PTC 25-2018)

field testing: testing of a pressure relief device installed on a system to determine some or all of its operating characteristics. It may be either of the following methods (a) in-place testing: testing of a pressure relief device installed on but not protecting a system, using an external pressure source, with or without an auxiliary lift device to determine some or all of its operating characteristics. (b) in-service testing: testing of a pressure relief device installed on and protecting a system, using system pressure or an external pressure source, with or without an auxiliary lift device to determine some or all of its operating characteristics. (PTC 25-2018)

fill: heat transfer devices placed in the tower for the purpose of facilitating direct contact between circulating water and air. (PTC 23-2003)

filter: a device for separating sound signal on the basis of frequency. (PTC 36-2018)

filter – nonprecoat: mechanical device primarily used for removal of particulate oxides from condensate or other liquids as pretreatment ahead of many types of high purity water treatment processes. The device may contain permanent elements or media that is mechanically or hydraulically cleaned every service cycle or disposable media that is replaced every service cycle. (PTC 31-2011)

filter – precoat: mechanical device primarily used for removal of particulate oxides from condensate. The device may contain tubular elements that are precoated with materials that can include various fibers, activated carbon, powdered ion exchange resins, or mixtures of those materials. The precoat material is replaced every service cycle. (PTC 31-2011)

filtering: electric, electronic, acoustic, optical, or software devices used to reject signals, vibrations, or radiations of certain frequencies while allowing others to pass. (PTC 19.22-2007)

fixed carbon: carbonaceous residue less the ash remaining in the test container after the volatile matter has been driven off in making the proximate analysis of a solid fuel in accordance with the appropriate ASTM standard (see also volatile matter). (PTC 4-2013, PTC 47-2006)
**fixed carbon:** the carbonaceous residue less the ash remaining in the test container after moisture and the volatile matter has been driven off in making the proximate analysis of a solid fuel in accordance with the appropriate ASTM standard. Also see volatile matter. (PTC 4.3-2017)

**flame emission spectroscopy:** a flame photometric technique in which a solution containing the sample to be analyzed is optically excited in an oxyhydrogen or oxyacetylene flame. Relaxation of the atomized particles to their ground states produces emission spectra that serve as the basis for qualitative and quantitative analysis. Emission spectra can arise from several types of particles, including atoms, ions, small molecules, and radicals. (PTC 19.11-2008)

**flare:** equipment used forcombusting vent gas, off-gas, or tail gas from the gasification process prior to emission to the atmosphere. (PTC 47-2006)

**flashing:** the process of producing steam by discharging water at saturation temperature into a region of lower pressure. (PTC 4.4-2008)

**floating pressure inlet:** a steam turbine operating mode in which the steam turbine inlet control valves are not modulated, usually controlled to 100% open. Since the control valve position remains constant, any change in inlet steam flow and, to a lesser degree, inlet steam temperature, will result in a change in inlet pressure. This mode of operation is often used in steam cycles that are the bottoming cycles for a combined cycle system. (PTC 6.2-2011)

**flow capacity:** the steam flow rate that will pass into the HP turbine system at the reference steam pressure and temperature and with the control valves 100% open. The reference conditions should be defined immediately upstream of all equipment within the scope of the test. For example, if separately-mounted protection or control valves at the inlet of the turbine are included within the scope of the test, the flow capacity should be defined at the entrance to these valves. (PTC 6.2-2011)

**flow capacity:** see measured relieving capacity. (PTC 25-2018)

**flow capacity testing:** testing of a pressure relief device to determine its operating characteristics including measured relieving capacity. (PTC 25-2018)

**flow rate:** quantity of cooling water passing through condenser per unit of time. (PTC 12.2-2010)

**flow metering run:** the entire section(s) of piping consisting of the primary element, flow conditioner (if applicable), and upstream and downstream piping, that conforms to the overall straight length and other manufacturing and installation requirements which are codified. (PTC 6.2-2011, PTC 51-2011)

**flow path:** the three-dimensional and geometric characteristics of a device that affects the measured relieving capacity. It is defined from the cross section of the inlet to the cross section of the outlet, including all streamlines in the flow. (PTC 25-2018)

**flow-rating pressure:** the inlet stagnation pressure at which the relieving capacity of a pressure relief device is measured. (PTC 25-2018)

**flow resistance:** a dimensionless term that expresses the number of velocity heads lost due to flow through a rupture disk device (where velocity head is one-half the velocity squared divided by the acceleration of gravity). (PTC 25-2018)

**flue gas:** gaseous products of combustion, including excess air. (PTC 4-2013, PTC 4.3-2017, PTC 47-2006, PTC 34-2017, PTC 40-2017, PTC 47.4-2015)

**flue gas analysis:** flue gas constituents as measured on a wet or dry volumetric basis (O2, CO2, CO, etc.). (PTC PM-2010)

**flue gas desulfurization (FGD) system:** the process and equipment employed to remove sulfur oxides from flue
gas or other sulfur-oxide-laden gas stream. The system may include process or equipment required for the conversion of the sulfur oxides to an essentially nonvolatile sulfur species for disposal or other use. The tobe-treated gas stream or streams are typically generated by the combustion of fossil fuels, but may include other gas streams (e.g., from smelting processes). The definition of FGD system in this Code does not address the removal of sulfur oxides from gases directly during the combustion process. (PTC-2017)

**flue gas (hot fluid) exit temperature — excluding leakage:** the temperature at which the flue gas would have exited the air heater if there were no leakage. If leakage is present, this parameter is calculated by energy balance. For the purposes of the energy-balance calculations, the temperature of the leakage flow, including any ingress air, is assumed to be the same as the entering air stream(s). (PTC 4.3-2017)

**flue gas (hot fluid) exit temperature — including leakage:** the measured temperature of the flue gas exiting the air heater. (PTC 4.3-2017)

**flue gas (hot fluid) side effectiveness:** the ratio of the flue gas temperature drop, excluding leakage, to the temperature head. (PTC 4.3-2017)

**flue gas (hot fluid) temperature drop — excluding leakage:** the decrease in the temperature of the flue gas passing through the air heater, based on the fluid exit temperature excluding leakage. (PTC 4.3-2017)

**fluid-flow nozzle:** fluid-flow measurement device in the style of an ASME-defined flow nozzle, with converging/diverging sections that use differential pressure to measure flow. (PTC 51-2011)

**fluidized bed:** a bed of suitably sized combustible and noncombustible particles through which a fluid (air in fluidized bed steam generators) is caused to flow upward at a sufficient velocity to suspend the particles and to impart to them a fluid-like motion. (PTC 4-2013, PTC 4.3-2017)

**fluidized bed:** bed of suitably sized combustible and noncombustible particles through which a fluid (predominantly air or oxygen and steam in fluidized bed generators) is caused to flow upward at a sufficient velocity to suspend the particles and to impart to them a fluid-like motion. (PTC 47-2006)

**fluidized bed, bubbling:** a fluidized bed in which the fluidizing air velocity is less than the terminal velocity of most of the individual particles. Part of the gas passes through the bed as bubbles. This results in a distinct bed region because an insignificant amount of the bed is carried away by the fluidizing air. (PTC 4-2013, PTC 4.3-2017)

**fluidized bed, bubbling:** fluidized bed in which the superficial gas velocity is less than the terminal velocity of most of the individual particles. Part of the gas passes through the bed as bubbles. This results in a distinct bed region, because the fluidizing gases carry an insignificant amount of the bed away. (PTC 47-2006)

**fluidized bed, circulating:** a fluidized bed in which the fluidizing air velocity exceeds the terminal velocity of most of the individual particles, so that they are carried from the combustion chamber and later reinjected. (PTC 4-2013, PTC 4.3-2017, PTC 47-2006)

**fluorescence:** measure of the presence of an indicating dye in percent of solution for use in determining flow rate in large conduits (percent). (PTC 12.2-2010)

**flutter:** abnormal, rapid reciprocating motion of the movable parts of a pressure relief valve in which the disk does not contact the seat. (PTC 25-2018)

**flux:** measure of the rate at which the preate passes though the membrane per unit area of membrane, for example, gal/ft²/day (gfd). (PTC 31-2011)

**flux technique:** measurement of droplets that pass through a fixed area during a specific time interval. It is a number or flux-weighted technique. (PTC 51-2011)

**fly ash:** see ash, fly. (PTC 34-2017)

**fogging:** the humidification of gas turbine inlet air by direct contact with water droplets (e.g., no evaporative
fogging performance factor: relates the amount of water used to cool the inlet air to the target temperature to the amount of water used to cool the air to saturation. (PTC 51-2011)

fogging spray nozzle: component of a fogging system employed to cause high-pressure water to be emitted into the inlet air-flow stream of the combustion turbine in the form of appropriately sized droplets. (PTC 51-2011)

foot: one-third of a yard, originally based on the length of a man’s foot. (PTC 19.5-2004)

force: units of pound or Newton; no one has ever seen a force. (PTC 19.5-2004)

forced draft: a mechanical-draft ACC in which the fans are located upstream of the heat transfer surface. (PTC 30.1-2007)

forced draft tower: type of mechanical draft tower in which the air-moving device is located at the air inlet. (PTC 23-2003, PTC 51-2011)

fouling: accumulated foreign material such as corrosion products or any other deposits on the heat transfer surface. (PTC 12.5-2000)

fouling: accumulation of entrained materials in gas passages or on heat-absorbing surfaces. See also slag. (PTC 34-2007)

free field: the region where the sound-pressure level decreases 6 dB from a given point source for each doubling of distance from the source. This region will exist if the sound source is in the free field or when in an enclosure, the enclosure is large enough so that the reverberant field had not been reached first. The acoustic field should be sufficiently distant from a distributed sound source so that the sound pressure decreases linearly with increasing distance (neglecting reflections, refraction, and absorption). (PTC 36-2018)

freeboard: the volume from the upper surface of the expanded bed to the exit of the furnace. This definition applies to a fluidized bed of dense solids (bubbling bed) in which there is an identifiable bed surface. It does not apply to a circulating fluidized bed. (PTC 4-2013)

freeboard: in certain ion exchange units and granular media filters, the space provided between the media/water interface and the water/collector/distributor to allow for expansion of the resin or media bed during backwashing, commonly expressed dimensionally or as a percentage of media depth. (PTC 31-2011)

freeboard: volume from the upper surface of the expanded bed to the entrance of the convection pass. This definition applies to a fluidized bed of dense solids (bubbling bed) in which there is an identifiable bed surface. It does not apply to a circulating fluidized bed. (PTC 47-2006)

freeboard disengaging: open area in the top of fluidized-bed gasification vessels for separation of solids from the gas. (PTC 47-2006)

free mineral acidity (FMA): amount of acidity present in water when leakage is subtracted from TMA; FMA = TMA – leakage. (PTC 31-2011)

frequency: frequency output of the generator. (PTC 29-2005)

frequency: The rate of change with time of the instantaneous phase of a sine function divided by $2\pi$, with the dimensions of cycles per second or hertz (Hz). (PTC 36-2018)

frequency and power transducers: measures generator operation and transmits this information to the governor in a form the governor can respond to. They consist of electrical devices and the necessary conditioning devices to provide a signal compatible with the governor. (PTC 29-2005)

fuel: a material that is burned to release its thermochemical energy. (PTC 34-2017)
**fuel gas contaminants** syngas contaminants include those compounds that are either potentially deleterious to the gas turbine and power block in general or are precursors to stack emissions. These include compounds that include elements such as sulfur (i.e., H₂S and COS), nitrogen (i.e., NH₃ and HCN), chlorine (i.e., HCl), tars and condensables (i.e., organic compounds designated as CₓHᵧ which may either be long chain hydrocarbons or cyclic compounds), particulates (i.e., inert ash and potentially corrosive components for the gas turbine, including vanadium, lead, calcium, and nickel), and volatilized alkali metals (i.e., sodium and potassium). (PTC 47-2006)

**fuel gas (syngas) rate** syngas consumption per hour per unit output in which the turbine is charged with the syngas quantity supplied. (PTC 47-2006)

**fuel energy** the amount of energy crossing the test boundary during a storage cycle in the form of combustible mass, i.e., the fuel rate multiplied by the higher heating value. (PTC 53-2018)

**fuel heat rate** the fuel energy divided by the discharge energy during a storage cycle, expressed as British thermal units per kilowatt-hour (kilojoules per kilowatt-hour). (PTC 53-2018)

**fuel rate** for solid and liquid fuels, the mass of fuel fired per unit of output. For gaseous fuels, it is defined as cubic feet of gas at 59°F and 14.696 psia (cubic meters at 15°C and 101.325 kPa) per unit of output. Fuel rates should be qualified by reference to the unit of output.1 (PTC 53-2018)

**full range (FR)** the absolute value of the algebraic difference between the minimum and maximum values for which the system is capable of measuring or generating. (PTC 19.22-2007)

**full scale** an instrument’s maximum reading or output for each of its ranges. May have a higher numeric value than the range setting due to overrange capability. (PTC 19.22-2007)

**furnace** an enclosed chamber for the combustion of fuel. (PTC 4-2013, PTC 4.3-2017, PTC 34-2017)

**furnace atomic absorption spectroscopy** an analytical technique based on the absorption of electromagnetic radiation by atomic particles. This technique, along with other spectral methods, requires that the sample be atomized, a process in which the sample constituents are decomposed and converted to gaseous elementary particles (atoms or ions). The absorption spectrum of the resulting atoms or ions then serves as the basis for qualitative and quantitative analysis for the elements contained within the sample. Furnace AA spectroscopy uses an electrothermal method of sample atomization. This type of atomization provides enhanced sensitivity compared with flame methods of atomization. (PTC 19.11-2008)

**gage** a device used on reclosing pressure relief devices to prevent the device from opening. (PTC 25-2018)

**gain error (scale error)** error in a signal due to nonlinearity in a device’s response. (PTC 19.22-2007)

**gage pressure, p** the value of a pressure when the datum is the barometric pressure at the point of measurement. It is the difference between the absolute pressure at a point and the pressure of the ambient atmosphere in which the measuring gage is located. It may be positive or negative. (PTC 11-2008)

**gage pressure** pressure measured with respect to the atmospheric pressure. (PTC 39-2005, PTC 51-2011)

**gage pressure transmitter** an instrument that measures pressure reference to atmospheric pressure and transmits the information. (PTC 51-2011)

**gas approach temperature** the difference of the gas temperature at the inlet or outlet to a heat transfer section and the corresponding fluid temperature. (PTC 4.4-2008)
gas generator: the section of the gas turbine (core, gasifier) that produced high pressure and high temperature air. It usually consists of the mechanically connected compressor, combustor, and turbine. The gas generator may be either a single- or multi-spool assembly. (PTC 55-2013)

gas generator: assemblage of equipment consisting of a compressor(s), combustor(s), and a turbine(s) that produces hot gases at elevated pressure. It may be either a single- or multi-spool (rotor) assemblage. (PTC 47-2006)

gas generator turbine: turbine portion of a gas generator. (PTC 47-2006)

gas side static pressure drop: the difference between the static pressure measured at the inlet test boundary and the atmosphere. (PTC 4.4-2008)

GT: gas turbine (PTC 4.4-2008)

GTE: the flue gas flowing through the HRSG from the GT exhaust. (PTC 4.4-2008)

gas turbine engine: machine that converts thermal energy into mechanical work. It consists of a compressor(s), a combustor or other thermal device(s) that heats the working fluid, a turbine(s), a control system, and auxiliary equipment. (PTC 47-2006)

gas turbine generator (GTG): the combination of gas turbine and the electric generator. (PTC 4.4-2008)

gas turbine power plant: gas turbine engine and all essential equipment necessary for the production of power in useful form. (PTC 47-2006, PTC 51-2011)

gas turbine: as used in this Code, the terms “aircraft gas turbine” and “gas turbine” are interchangeable. The gas turbine is a machine, which convert thermal energy into mechanical work or propulsive thrust. A gas turbine produces a great amount of energy for its size and weight. It consists of compressor(s), thermal device(s) and heats the working fluid, turbine(s), a control system, and auxiliary equipment. (PTC 55-2013)

gas turbine: machine that converts thermal energy into mechanical work; it consists of one or several rotating compressors, a thermal device(s) that heats the working fluid, one or several turbines, a control system, and essential auxiliary equipment. Any heat exchangers (excluding exhaust heat recovery exchangers) in the main working fluid circuit are considered to be part of the gas turbine. It includes the gas turbine and all essential equipment necessary for the production of power in a useful form (e.g., electrical, mechanical, or thermal) within the test boundary. (PTC 22-2014, PTC 51-2011)

gaseous fuel: mixture of combustibles with or without inerts in which each component is present as a superheated or saturated vapor under conditions of use. (PTC 22-2014)

gasification: partial oxidation of a hydrocarbon feed into a combustible fuel gas (syngas), usually composed primarily of hydrogen, carbon monoxide, and methane. (PTC 47-2006)

gasifier: vessel in which the gasification reactions take place. (PTC 47-2006)

gate limit: a device that acts on the governor system to prevent the turbine-control mechanism from opening beyond the position that the device is set. (PTC 29-2005)

gEEPound or slUG: 1 slug weighs 32.174 lb at sea level and 45 deg. of latitude. (PTC 19.5-2004)

governing system or governor system: the combination of devices and mechanisms that respond to changes of speed, power, water level or their setpoints, and position the turbine servomotor(s) in a characteristic manner. Includes the position transducer, speed sensing device, the speed responsive elements, the hydraulic control mechanism and the hydraulic pressure supply system. (PTC 29-2005)

gram: the mass of 1 cubic centimeter of pure water in a vacuum at its maximum density. (PTC 19.5-2004)
grit: impurities in as-received calcined lime, e.g., uncalcined carbonate, hard-burned lime, insoluble silicates, aluminates, sulfates, and ferrites, that were in the limestone before it was calcined. Grit may also include some external impurities, e.g., refractory brick pieces and tramp iron (PTC 40-2017)

gross generation: total electrical output from the generator terminals. (PTC PM-2010)

gross heat of combustion at constant volume: heat produced by the combustion of unit quantity of solid or liquid fuel when burned at constant volume in an oxygen bomb calorimeter under specified conditions, with the resulting water condensed to a liquid. Expressed in MJ/kg (Btu/lbm). (PTC 47-2006)

guarantee location: the physical location at which a guaranteed parameter is to be determined. (PTC 30.1-2007)

guarantee values: specified or predicted operating conditions for which the design of the ACC was guaranteed. Also called guarantee point, case, or conditions. (PTC 30.1-2007)

guide: a component in a direct spring- or pilot-operated pressure relief device used to control the lateral movement of the disk or disk holder. (PTC 25-2018)

$H$

hardness: scale-forming and lather-inhibiting qualities possessed by water, high in calcium and magnesium ions. (PTC 31-2011)

hardness, permanent: caused by the presence of calcium sulfate, magnesium sulfate, and the chlorides of these two metals that cannot be removed by boiling. (PTC 31-2011)

hardness, temporary: caused by the presence of magnesium or calcium bicarbonate; referred to as temporary because the hardness may be removed by boiling the water to convert the bicarbonates to the insoluble carbonates. (PTC 31-2011)

hardness, total: numeric sum of the hardness ions calcium and magnesium, both expressed as calcium carbonate (CaCO$_3$), that is used to determine work loading in simple ion exchanged softening. (PTC 31-2011)

hardness, total acidified: numeric sum of the hardness ions calcium and magnesium, both expressed as calcium carbonate (CaCO$_3$), in a sample that has been acidified to dissolve unreacted lime carryover in the effluent of lime softening processes. (PTC 31-2011)

hardness as calcium carbonate: expression ascribed to the value obtained when the hardness-forming salts are calculated in terms of equivalent quantities of calcium carbonate, a convenient method of reducing all salts to a common basis for comparison. (PTC 31-2011)

heat: energy in transit between a source at a higher temperature from which the energy is coming to a sink toward which the energy is going. Other types of energy in transit are called work. (PTC 19.5-2004)

heat balance: the utilization of the first law of thermodynamics (a.k.a., conservation of energy, wherein energy can be neither created nor destroyed; only converted from one form to another) to reconcile incoming and outgoing streams of energy. (PTC 34-2017)

heat balance diagram: a diagram expressing temperature, pressure, enthalpy, and flow values throughout the cycle for a given set of conditions. (PTC PM-2010)

heat capacity ratio (X-ratio): the ratio of the mean heat capacity of the air passing through the air heater to the mean heat capacity of the flue gas passing through the air heater. For a multi-sector air heater, the air-side component is based on the composite air-side temperatures. (PTC 4.3-2017)

heat credits: the net sum of heat transferred to the system by flow streams entering the envelope (excluding fuel combustion energy) plus exothermic chemical reactions and motive power energy of auxiliary equipment within the steam generator envelope. (PTC PM-2010)
heat input: the flow of fuel(s) multiplied by the higher or lower heating value of the fuel(s) (PTC 22-2014)

heat input: mass flow rate of fuel(s) multiplied by the high or low heating value of the fuel(s). (PTC 47-2006)

heat input: flow of fuel(s) multiplied by the high or low heating value of the fuel(s). (PTC 50-2002)

heat input: the energy entering the test boundary. (PTC 46-2015)

heat of combustion: heat released from the complete oxidation from a fuel with the reactant products at a reference condition. (PTC 47-2006)


heat load: the rate of heat removal, or the amount of heat required to be dissipated from a heat exchanger. (PTC 51-2011)

heat loss: energy quantity that leaves the test boundary outside defined exits. (PTC 22-2014, PTC 51-2011)

heat loss method: calculation method to determine steam generator efficiency expressed in percent based on accountable losses from the boiler. (PTC PM-2010)

heat rate \([\text{kJ/kWh or Btu/(kW·h)}]\): heat input per unit of power output, based on either the low or high heating value of the fuel. (PTC 50-2002)

heat rate: ratio of the fuel heat input to the power output produced by the gas turbine as measured at the test boundaries. The basis of the value should always be expressed as either lower heating value or higher heating value. (PTC 22-2014)

heat rate: the reciprocal of thermodynamic efficiency, expressed as the quotient of thermal heat input to electrical power output. When there are secondary heat inputs or outputs, such as steam for the process generated by a cogeneration power plant, the heat rate is expressed at specified reference values of those secondary heat flows. (PTC 46-2015)

heat rate: heat consumption per hour per unit output. The turbine is charged with the aggregate enthalpy of the steam supplied plus any chargeable aggregate enthalpy added by the reheaters. It is credited with the aggregate enthalpy of feedwater returned from the cycle to the steam generator. Turbine-generator performance may be defined on the basis of the gross power output at the generator terminals less the power used by the minimum electrically-driven turbine auxiliaries and excitation equipment, supplied as part of the turbine-generator unit, required for reliable and continuous operation. (PTC 6-2004, PTC 6A-2000)

heat rate (mechanical or electrical): heat input per unit of power output. (a) For gas turbine heat rate, the turbine is charged with the aggregate heat content (heat of combustion plus enthalpy) of the fuel gas supplied plus any chargeable aggregate enthalpy added by other feed streams and feed-stream heaters. It is credited with the aggregate enthalpy of any compressed air streams leaving the turbine envelope. Turbine-generator performance is normally defined on the basis of the gross power output at the generator terminals less the power used by the minimum electrically-driven turbine auxiliaries and excitation equipment, supplied as part of the turbine-generator unit, required for reliable and continuous operation. (b) For steam turbine heat rate, the turbine is charged with the aggregate enthalpy of the steam supplied plus any chargeable aggregate enthalpy added by the reheaters. It is credited with the aggregate enthalpy of the feedwater returned from the cycle to the steam generator. Turbine-generator performance is normally defined on the basis of the gross power output at the generator terminals less the power used by the minimum electrically-driven turbine auxiliaries and excitation equipment, supplied as part of the turbine-generator unit, required for reliable and continuous operation. (PTC 47-2006)

heat rate (mechanical or electrical): the fuel heat input per unit of power output, based on either the low or high heat value of the fuel, which shall be specified. (PTC 47.4-2015)

heat rate, gross: the ratio of the total energy input to the unit to the gross electrical generation. (PTC PM-2010)
heat rate, gross turbine: the ratio of the energy input to the turbine cycle to the gross electrical generation. (PTC PM-2010)

heat rate, incremental: the energy input change required to produce the next increment of load on the unit. (PTC PM-2010)

heat rate, net: the ratio of the total energy input to the unit to the net electrical generation. (PTC PM-2010)

heat recovery gasification process: process employing a heat exchanger(s) to transfer the heat (radiant and/or convective) contained in the synthesis gas exiting the gasification vessel to a medium such as steam. Examples of this equipment include radiant syngas coolers, firetube boilers, and waterwall type boilers. (PTC 47-2006)

heat recovery steam generator (HRSG): heat exchanger(s) to transfer the heat (radiant and/or convective) contained in the exhaust gas from a gas turbine to steam. (PTC 47-2006)

heat sink: the reservoir to which the heat rejected by the system is transferred. For a cooling pond, river, lake, or ocean cooling system, the reservoir is the body of water. For an evaporative or dry air-cooled heat exchanger system, the reservoir is the ambient air. (PTC 46-2015, PTC 50-2002, PTC 51-2011)

heat transfer area: the area of the wall surface over which heat is transferred from the hot fluid to the cold fluid. (PTC 12.5-2000)

heat-transfer coefficient: rate of heat transfer per unit of surface area and temperature difference (PTC 12.2-2010)

heat transfer rate: the amount of heat transferred from the hot stream to the cold stream per unit of time. (PTC 12.5-2000)

heater: a section wherein fluid other than water or steam is heated. (PTC 4.4-2008)

heater: a device that is used to increase the temperature of ambient air prior to its entering the compressor inlet. (PTC 51-2011)

heating surface: the surface that is exposed to the heating medium (gas turbine exhaust or hot gas) for absorption and transfer of heat to the heated medium (water, steam, or air). (PTC 4.4-2008)

heating value: energy released when a fuel and oxidant, normally at 25°C (77°F), are burned to completion and the products of combustion are cooled to a specified temperature, normally 25°C (77°F). Although the units of heating value may be energy per unit mole (MJ/kg-mol, Btu/lb-mol) or energy per unit volume (MJ/N-m³, Btu/scf), the units of heating value used in this Code are energy per unit mass (MJ/kg or Btu/lbm). Heating value may be reported as either lower (net) heating value or higher (gross) heating value, as long as all fuels, product gases, and syngases are reported using consistent terms. Lower heating value (LHV) is calculated as if all H₂O in the combustion products remains in the vapor state. Higher heating value (HHV) is calculated as if all H₂O in the combustion products were condensed, and includes the heat released by that condensation of all H₂O in the combustion products, including any moisture initially present in the fuel and oxidant. Moisture in the fuel–oxidant mixture evaporates during combustion, consuming the same amount of energy as it releases during post-combustion condensation, so the net calculated condensation energy represents only the H₂O formed from the combustion of hydrogen. (PTC 47-2006)

heating value: the amount of thermal energy released by complete combustion of a fuel unit at constant pressure. (PTC 46-2015)

heating value, higher: the total energy liberated per unit mass of fuel upon complete combustion as determined by appropriate ASTM Standards. The higher heating value includes the latent heat of the water vapor. When the heating value is measured at constant volume, it must be converted to a constant pressure value for use in this Code. (PTC 4-2013, PTC 4.3-2017)

heating value, higher (gross calorific value): the total energy liberated per unit mass of fuel upon complete
combustion. The higher heating value includes the latent heat of the water vapor. (PTC 34-2007)

**heating value, lower**: the total heat liberated per unit mass of fuel minus the latent heat of the water vapor in the products of combustion as determined by appropriate ASTM Standards (not used in this Code) (PTC 4-2013, PTC 4.3-2017)

**heating value, lower (net caloric value)**: the total heat liberated per unit mass of fuel minus the latent heat of the water vapor in the products of combustion. (PTC 34-2017)

**hertz (Hz)**: see frequency (PTC 36-2018)

**high heat value (HHV)**: the heat produced by combustion of a unit quantity of gaseous, liquid, or solid fuels under specified conditions, expressed in J/kg (Btu/lbm). All water vapor formed by the combustion reaction is condensed to the liquid state. (PTC 47.4-2015)

**high heating value (HHV)**: the heat of combustion, per unit quantity of fuel, when all combustion product water is condensed to liquid water and all associated heat is recovered. This is the highest possible heat of combustion of a particular fuel at specified conditions and is typically the heating value paid for by the fuel buyer. (PTC 50-2002)

**higher heating value (HHV) at constant pressure (gaseous fuels)**: the heat produced by the combustion of a unit quantity of gaseous fuel(s) at constant pressure under specified conditions. All water vapor formed by the combustion reaction is condensed to a liquid state. (PTC 22-2014)

**higher heating value (HHV) at constant volume (liquid fuels)**: the heat produced by the combustion of a unit quantity of liquid fuel at constant volume under specified conditions, as in an oxygen bomb calorimeter. All water vapor from the combustion reaction is condensed to the liquid state. (PTC 22-2014)

**higher heating value**: see heating value. (PTC 47-2006)

**higher heating value (HHV)**: the total heat obtained from the combustion of a unit amount of fuel that is at 60°F when combustion products are cooled to 60°F. (PTC 4.4-2008)

**higher heating value**: the total energy released by the complete combustion of the fuel. This includes the heat of vaporization of all moisture. (PTC PM-2010)

**higher heating value**: heat released from the rapid oxidation of fuel. Heating value of fuels is determined in accordance with the following Codes:

- ASME PTC 3.1, Diesel and Burner Fuels
- ASME PTC 3.2, Solid Fuels
- ASME PTC 3.3, Gaseous Fuels

Each Code will specify using either the higher or lower heating value, typically expressed as British thermal units per pound mass (kilojoules per kilogram).

Water vapor is one of the products of combustion for all fuels that contain hydrogen. The higher heating value of a fuel depends on whether this water vapor is allowed to remain in the vapor state or is condensed to liquid. In a bomb calorimeter, the products of combustion are cooled to the initial temperature and all of the water vapor formed during combustion is condensed to liquid. This gives the higher, or gross, heating value of the fuel with the heat of vaporization included in the reported value. (PTC 53-2018)

**higher heating value constant volume (HHVυ)**: determined by measuring the heat of combustion or the amount of heat rejected by the constant-volume system in the bomb when burning a carefully weighed quantity of liquid fuel in the oxygen-filled calorimeter bomb. All heat values are reference to a standard temperature of 77°F (25°C). (PTC 55-2013)

**hollow fiber modules**: membrane material spun into hollow, hair-like fibers 200 μm diameter or less. (PTC 31-2011)

**hot acid gas removal process**: acid gas removal process operating at elevated temperatures and employing gas/solid reactions to remove acid gases. (PTC 47-2006)
hot gas desulfurization: process to remove sulfur compounds from the syngas at elevated temperatures. Examples are direct injection of calcium-based sorbent into the gasifier or direct contact of syngas with metal oxide sorbent. (PTC 47-2006)

hot gas particulate removal system: system to remove particulate matter from the hot syngas using a barrier-type filter, including ceramic candle filter, fiber filter, screenless granular bed filter, and cross-flow filter. (PTC 47-2006)

hot stream: flow stream with the higher heat exchanger inlet temperature. (PTC 12.5-2000)

hot stream temperature change: the difference between the inlet and outlet temperatures of the hot stream. (PTC 12.5-2000)

hot water temperature: weighted average temperature of heated water entering a system heat-rejection component (e.g., cooling tower for a chiller system, heat exchanger, etc.). (PTC 51-2011)

hot water temperature: weighted average temperature of circulating water entering the tower. (PTC 23-2003)

HP-IP turbine shaft leakage: the steam leakage from the HP turbine to the IP turbine through the shaft seals of a combined HP-IP element, sometimes called N2 or dummy gland leakage. (PTC PM-2010)

hot leg temperature: in a pressurized water reactor plant, the temperature of water exiting the reactor and entering the steam generator. (PTC PM-2010)

HRSG: see heat recovery steam generator. (PTC 4.4-2008, PTC 47-2006)

huddling chamber: the annular pressure chamber between the nozzle exit and the disk or disk holder that produces the lifting force to obtain a pop action. (PTC 25-2018)

humidity ratio: mass of water vapor in a gas per pound of dry gas (also see specific humidity). (PTC 4.3-2017)

hybrid systems (EDI, EDR): may combine elements of both ion exchange and membrane technologies, which will typically consist of all equipment, including service vessels, media, all piping, pumps, valves, controls, and instrumentation. (PTC 31-2011)

hydraulic power unit: consists of the necessary oil pumps, motors, pressure regulating devices, pressure switches, and oil sump tank necessary to provide hydraulic power to the governor system. (PTC 29-2005)

hydraulic pressure supply system: includes the HPU, pressure accumulator and the necessary piping connections to the turbines servomotors. (PTC 29-2005)

hydraulic resistance: resistance to flow due to form losses and friction in the heat exchanger. (PTC 12.5-2000)

hydrogen cycle: operation of a cation exchange cycle wherein the removal of specified cations from the influent water is accomplished by exchange with an equivalent amount of hydrogen ion from the exchange material. (PTC 31-2011)

impingement nozzle: a fogging nozzle in which a stream of high-pressure water is directed to the tip of an impact pin where the stream of water is sheared to produce for-size droplets. (PTC 51-2011)

inch: the twelfth part of a foot, originally established by statute, apparently of Edward II, given in the Cottonian Manuscripts (Claudius D.2) to be that of three grains of barley dry and round placed end to end lengthwise. (PTC 19.5-2004)

incidental material: the amount of mass crossing the test boundary into the storage container during the standby state, which may increase the internal energy of the storage medium. (PTC 53-2018)
**incremental cost:** the cost associated with the generation of the next increment of load on a unit. (PTC PM-2010)

**indirect evaporative cooler:** an evaporative cooling system in which the evaporation process is external to the inlet air stream and does not increase the moisture content of the inlet air stream. An example would be circulating water from a cooling tower through coils in the inlet air duct. (PTC 51-2011)

**induced draft:** a mechanical-draft ACC in which the fans are located downstream of the heat transfer surface. (PTC 30.1-2007)

**induced draft tower:** type of mechanical draft tower in which the air-moving device is located at the air exhaust. (PTC 23-2003, PTC 51-2011)

**induction flow:** any steam flow from a source external to the steam turbine that is introduced into the turbine steam path downstream of the HP turbine inlet. Turbine shaft packing leak-offs that are re-introduced to the steam path are not considered induction flows. For reheat cycles, steam flows introduced within the reheater system are also considered induction flows. Induction flows are also often called admission flows. (PTC 6.2-2011)

**inert gas generator:** system of the GCC plant that generates an inert gas (i.e., gas typically containing less than 0.1% oxygen by volume) such as nitrogen or carbon dioxide. The inert gas is used for purging equipment or piping, where the presence of excess oxygen is undesirable. (PTC 47-2006)

**inert matter:** constituents of coal or gas that decrease its efficiency in use, e.g., mineral matter (ash) in coal and moisture in fuel for combustion. Also refers to nonreactive gases such as nitrogen or argon that may be contained in the air or oxygen used for the gasification process, transport gas for moving coal in dry gasifier processes, purge and blanketing gas used in the gasification and combined cycle processes, and carbon dioxide produced by combustion. (PTC 47-2006)

**influence coefficient:** the ratio of the change in a result to a unit change in a parameter. (PTC 47.4-2015, PTC 50-2002, PTC 70-2014)

**influence coefficient:** see *sensitivity* (PTC 19.1-2018)

**influence coefficient:** the ratio of the change in a result to a unit change in a parameter. (PTC 29-2005, PTC 46-2015, PTC 47.1-2017)

**influence coefficient:** see absolute and/or relative sensitivity (influence) coefficient. (PTC 4.3-2017)

**influent:** liquid, solid, or gaseous material being introduced into a process; in this Code, untreated or partially treated water introduced for processing into an ion exchange system. (PTC 31-2011)

**initial temperature difference (ITD):** the difference between the saturated steam temperature at the condenser pressure and the inlet air temperature. (PTC 30.1-2007)

**injection fluid:** gaseous or liquid stream that enters the test boundary. (PTC 51-2011)

**injection fluid: non-fuel** gaseous or liquid stream that enters the test boundary. (PTC 22-2014)

**inlet air:** air that enters the test boundary at the planes of applicable plant equipment. (PTC 46-2015)

**inlet air temperature:** the temperature of the air entering the ACC, including the effect of any recirculation and/or interference. (PTC 30.1-2007)

**inlet air-conditioning:** the devices used to cool or heat the inlet air prior to entry into the gas turbine compressor. The test boundary must clearly state whether the device is inside or outside of the scope of the test. (PTC 22-2014)

**inlet air treatment device:** the device used to cool or heat the inlet air prior to entry into the gas turbine
inlet area: the cross-sectional flow area at the inlet opening of a pressure relief device. (PTC 25-2014)

inlet scroll: also known as bellmouth, the fixed area entrance to the gas turbine. (PTC 46-2015)

inlet/diffuser: a device that captures incoming air and directs it into the gas turbine. (PTC 55-2013)

inlet manifold: the last section of inlet duct that the air-flows through before entering the inlet bell mouth. (PTC 51-2011)

inlet pressure: gage pressure measured at the steam-trap inlet. (PTC 39-2005)

inlet size: the nominal pipe size of the inlet of a pressure relief device, unless otherwise designated. (PTC 25-2014)

inlet subcooling: the difference between saturated steam temperature corresponding to the inlet pressure and the temperature of the condensate at the steam-trap inlet. Inlet subcooling may be expressed as degrees Fahrenheit or degrees Kelvin. (PTC 39-2005)

input: the total thermochemical energy available from the fuel. Input is based on the higher heating value. (PTC 4-2013, PTC 34-2017)

input from fuel: the total chemical energy available from the fuel. Input is based on the higher heating value. (PTC 4.3-2017)


input–output method: calculation method to determine steam generator efficiency expressed in percent based on the ratio of heat output to heat input. (PTC PM-2010)

input–output test: a test conducted to quantify the unit fuel usage versus electrical output (PTC PM-2010)

insensitivity: one half of the deadband. (PTC 29-2005)

inside out: term used in cartridge and membrane filtration to describe flow path of liquid from internal passage to the outside. (PTC 31-2011)

in situ: see regeneration (in place, in situ). (PTC 31-2011)

instrument: a tool or device used to measure the physical value of a variable. These values can include size, weight, pressure, temperature, velocity, fluid flow, voltage, electric current, density, viscosity, gas composition, and power. Sensors are included that may not, by themselves, incorporate a display but transmit signals to remote computer-type devices for display, processing, or process control. Also included are items of ancillary equipment directly affecting the display of the primary instrument (e.g., ammeter shunt). Also included are tools or fixtures used as the basis for determining part acceptability. (PTC Template, PTC 11-2008, PTC 47.1-2018, PTC 50-2002, PTC 51-2011, PTC 70-2009)

instrument: a tool or device used to measure the value of a variable. (PTC 18-2002)

instrument: a tool or device used to measure physical dimensions of length, thickness, width, weight, or any other value of a variable. These variables can include size, weight, pressure, temperature, fluid flow, voltage, electric current, density, viscosity, and power. Sensors are included that may not, by themselves, incorporate a display but transmit signals to remote computer-type devices for display, processing, or process control. Also included are items of ancillary equipment directly affecting the display of the primary instrument, e.g., an ammeter shunt, and tools or fixtures used as the basis for determining part acceptability. (PTC 47.4-2015)
instrument: a tool or device used to measure physical dimensions of length, thickness, width, weight, or any other value of a parameter. These parameters can include size, weight, pressure, temperature, fluid flow, voltage, electric current, density, viscosity, and power. Sensors are included that may not, by themselves, incorporate a display but transmit signals to remote computer-type devices for display, processing, or process control. Also included are items of ancillary equipment directly affecting the display of the primary instrument, e.g., ammeter shunt. Also included are tools or fixtures used as the basis for determining part acceptability. (PTC 46-2015)

instrument: any tool or device used in the measurement of the present value of a physical, electrical, or chemical variable. These variables can include pressure, temperature, fluid flow, voltage, electric current, chemical composition, density, viscosity, size, and power. This includes sensors and any ancillary equipment used to transmit, display, and record these variables. (PTC 4.3-2017)

instrument transformer: transformer that is intended to reproduce in its secondary circuit, in a definite and known proportion, the current or voltage of its primary circuit with the phase relations substantially preserved. An instrument transformer is used to convert potentially dangerous voltage or current levels to a safer level suitable for a measuring instrument. (PTC 19.6-2018)

instrument uncertainty: an estimate of the limit of the error of a measurement; the interval about the measurement that contains the true value for a given confidence level. (PTC 30.1-2007)

integral deaerator: a deaerator that is directly connected to the low-pressure drum. (PTC 4.4-2008)

integral gain: the slope of the governor transient response with $b_p = 0$, and input signal $x = 1$. $K_0=K_r=0$. (PTC 29-2005)

integrated gasification combined cycle (IGCC) power plants: facilities using processes that, by reactions with oxygen, steam, carbon dioxide, as well as thermal decomposition, convert (partially combust) hydrocarbon fuel(s) into a gaseous stream of combustible components comprised of hydrogen, carbon monoxide, methane, and other by-products of the reactions. The resulting gas is fired in a gas turbine to produce power, followed by heat recovery from the exhaust gases to produce steam for additional power generation in a steam turbine. IGCC plants may also produce export syngas and export steam. (PTC 47-2006)

integrated sampling: the practice of passing a water sample through a filter and/or ion exchange membrane to retain and concentrate particulate and/or ionic materials (primarily corrosion products) from the sample for subsequent analysis. Both the flow rate and duration of sampling period are recorded to allow calculation of concentrations. (PTC 19.11-2008)

integration: linking of process streams between the major subsystems of the GCC facility, other than major product streams such as syngas from the gasifier to the gas turbine. Examples of integration include steam produced in the gasifier being sent to the combined cycle, air being extracted from the gas turbine and sent to the air separation unit, and nitrogen produced in the air separation unit being sent to the gas turbine. (PTC 47-2006)

intercooler: heat exchanger for cooling a fluid between stages of compression. (PTC 47-2006)

interference: the thermal contamination of tower inlet air by air from a source extraneous to the tower. (PTC 23-2003)

interference: the thermal contamination of ACC inlet air by a source extraneous to the ACC. (PTC 30.1-2007)

interlaboratory comparisons: the organization, performance, and evaluation of calibrations on the same or similar items by two or more laboratories in accordance with predetermined conditions. (PTC 46-2015)

internal energy: a state variable; its change from one state to another is independent of the process that produces the change. Internal energy changes, rather than absolute values, are important. Internal energy may be set to any convenient base. For steam, this base has been set at the triple point, 32°F and 0.0891 psia (273.15 K and 611.2 Pa). The symbol for internal energy is $u$, and it is expressed as British thermal units per pound mass (joules per kilogram). (PTC 53-2018)
interstage: between the heat transfer sections. (PTC 4.4-2008)

ion exchange: a reversible process by which ions are interchanged between an insoluble material and a liquid. Ion exchange material has the ability to exchange reversibly certain ions in its structure or attached to its surface as functional groups, with ions in surrounding medium. These ion-exchange materials may be cationic or anionic and are capable of reversible exchange of positively or negatively charged ions, respectively. (PTC 19.11-2008)

ion exchange: reversible process by which ions are interchanged between a solid and a liquid with no substantial structural changes of the solid. (PTC 31-2011)

ion exchange capacity (operating): portion of the total ion exchange capacity of an ion exchange resin bed that can be achieved in a practical ion exchange operation. Commonly expressed in kilograms per cubic foot (kgr/ft³) or equivalents per liter (eg/L). (PTC 31-2011)

ion exchange capacity (volume): also referred to as total exchange capacity (TEC) or wet volume capacity, it is the theoretical number of exchangeable ions per unit volume or weight of resin. The TEC can only be attained by a total and complete regeneration that is not employed in practice due to the prohibitive regenerant costs that would be required. TEC is typically expressed in terms of kilogram capacity per cubic foot (kgr/ft³) of resin material. (PTC 31-2011)

ion exchange capacity (weight basis): also referred to as dry volume capacity, the number of milliequivalents of exchangeable ions per dry gram of ion exchange material in its standard form. (PTC 31-2011)

ion exchange material: insoluble solid that has the ability to exchange reversibly certain ions in its structure or attached to its surface as functional groups with ions in a surrounding medium. (PTC31-2011)

ion exchange membrane: a membrane made from an ion exchanging polymer for the purpose of removing ion constituents from aqueous solutions. The use of ion exchange membrane requires the transfer of ions to the membrane polymer, which returns an equivalent number of ionic species stored on the membrane. (PTC 19.11-2008)

ion exchange resin: synthetic organic ion exchange material, usually in spherical form. (See also anion exchange and cation exchange materials.) (PTC 31-2011)

ion exchange resin – powdered: finely divided particles of crushed ion exchanged resin beads used as a disposable precoat filter material in condensate purification systems. (PTC 31-2011)

ion exchange systems: typically consist of all equipment, including service vessels, ion exchange resins, all piping, pumps, valves, controls, and instrumentation and may be designed for
(a) in-place resin regeneration that is performed in the service vessel.
(b) external regeneration that is accomplished in specifically designed regeneration vessels that are part of the particular ion exchange system.
(c) external regeneration that is accomplished in specifically designed regeneration vessels off site.
(d) nonregenerable. These resins are normally disposed of after their service capacity has been utilized. (PTC 31-2011)

ion exchange unit (conventional): unit in which back wash freeboard is included above the resin bed and that is backwashed before every regeneration or very frequently. (PTC 31-2011)

ion exchange unit (packed bed): unit, which is essentially completely full of resin along with an inert resin layer, and that is regenerated in a countercurrent fashion. The system may or may not be designed to include in situ backwash and may or may not require infrequent, external backwash. (PTC 31-2011)

ion selective electrode: an analytical technique for measuring ionic constituents primarily in aqueous solutions. This technique is based on the measurement, using a specific ion meter, of an ion exchange potential that is developed at the active surface of the electrode. The potential varies with the logarithm of the concentration of ions in the sample. Common examples are pH, sodium, and chloride electrodes. (PTC 19.11-2008)

iron: may be soluble or a particulate oxide. (PTC 31-2011)
isolated operation: the generating unit is the only source of electrical energy supplying the electrical load, if any. (PTC 29-2005)

\[ J \]

joule: work done when the point of application of a force of 1 N is displaced a distance of 1 m in the direction of the force. (PTC 47-2006)

joule: the unit of work or energy equal to the work done by a force of 1 N when the point at which the force is applied is displaced 1 m in the direction of said force. Also known as a newton-meter of energy. It is also practically equivalent to the energy expended by an electric current of 1 A flowing for 1 s through a resistance of 1 Ω. (PTC 19.5-2004)

\[ K \]

kilograms per cubic foot (kgr/ft³): concentration of ions that can be removed by a cubic foot of ion exchange resin. Kilograms per cubic foot can be converted to equivalents per liter by dividing by 21.8. (PTC 31-2011)

kinetic energy correction factor: a dimensionless factor used to account for the difference between the true average kinetic energy of the fluid and the kinetic energy calculated as one half the square of the average velocity. (PTC 11-2008)

knife blade: a component with multiple blades used with reverse-acting rupture disks to cut the disk when it reverses. (PTC 25-2018)

\[ L \]

laboratory calibration: the process by which calibrations are performed under controlled conditions with highly specialized measuring and test equipment that has been calibrated by approved sources, and remain traceable to the National Institute of Standards and Technology (NIST) or a recognized natural physical (intrinsic) constant through unbroken comparisons having defined uncertainties. (PTC 46-2015, PTC 51-2011)

leak pressure: see start-to-leak pressure. (PTC 25-2014)

leak test pressure: the specified inlet static pressure at which a quantitative seat leakage test is performed in accordance with a standard procedure. (PTC 25-2014)

leakage: amount of influent ion or contaminant present in the processed, effluent water. Generally, a function of regenerant level of the ion exchange resin material, and also a function of the flow dynamics within the exchanger. May be expressed as a percentage of inlet concentration, or in dimensionless part-per-million (ppm) or part-per-billion (ppb) ion or salt terms. (PTC 31-2011)

least significant bit (LSB): right most bit in a binary word whose value contributes the least to the overall value of the binary word and also represents the resolution of the digital word. (PTC 19.22-2007)

level: in acoustics, logarithm of the ratio of a variable quantity to a corresponding reference value of the same units. The base of the logarithm, is assumed to be 10. Unless otherwise specified, the reference value and the kind of level are to be specified. See also ANSI/ASA S1.8. (PTC 36-2018)

lift: the actual travel of the disk away from closed position when a valve is relieving. (PTC 25-2018)

lift lever: a device to apply an external force to the stem of a pressure relief valve to manually operate the valve at some pressure below the set pressure. (PTC 25-2018)

ligament: the relation of the liquid in the air stream prior to discreet atomization. Water initially sprayed from an
atomizing nozzle initially shears from water flow stream into ligaments before achieving a spherical droplet shape. (PTC 51-2011)

*light-scattering (diffraction) instrument:* a measurement system that is used to determine the size distribution of particles based on the light-scatter pattern that is measured using diodes. The scatter pattern from a population of particles can be deconvoluted mathematically to infer a size distribution based on known light-scattering principles. (PTC 51-2011)

*liquid fuel:* mixture of combustibles with or without inerts, which is composed almost entirely of liquid components under conditions of use. (PTC 22-2014)

*liquor:* solution of liquid and dissolved solids. (PTC 40-2017)

*LMTD:* log mean temperature difference, as computed from condenser heat load. (PTC 30.1-2007)

*lock hopper:* mechanical device that permits the introduction or withdrawal of bulk solid material into an environment of different pressure. A lockhopper usually consists of a pressure vessel with valves to contain pressurized solids and to depressurize contained solids. (PTC 47-2006)

*locus curve:* the continuous curve connecting the valve points. (PTC 6-2004)

*log mean temperature difference:* computed logarithmic mean temperature difference between steam and cooling water. (PTC 12.2-2010)

*log mean temperature difference (LMTD):* often used in heat exchanger calculations because the temperature gradient is not constant along the length of the exchanger. Let the temperature difference of the two fluids on the A side of a heat exchanger be represented by dTA, and let dTB represent the B side. The LMTD is \((dTA - dTB)/\ln(dTA/dTB)\). (PTC PM-2010)

*loop calibration:* calibration of the instrument through the signal-conditioning equipment including the recording device. (PTC 51-2011)

*loss due to unburned carbon:* heat loss expressed in Btu/lb of as-fired fuel due to unburned carbon in the ash. (PTC PM-2010)

*loss of ignition (LOI):* percent weight change when ash sample is heated to oxidize combustibles. (PTC PM-2010)

*losses:* energy other than the defined exit streams that exits the test boundary. (PTC 47.1-2017)

*losses:* the energy that exits the steam generator envelope other than the energy in the output stream(s). (PTC 4-2013, PTC 4.3-2017, PTC 34-2017)

*losses:* energy that exits an equipment or group of equipment envelope other than the energy in the output stream(s). Examples are heat lost to the atmosphere, losses because of mechanical inefficiencies, and steam turbine condenser heat loss. (PTC 47-2006)

*losses:* the energy that exits an equipment or envelope of equipment other than the energy in the output stream(s). Examples are heat lost to the atmosphere and to mechanical inefficiencies or cooling water. (PTC 47.4-2015)

*loss on ignition:* commonly referred to as “LOI.” The loss in mass of a dried dust sample, expressed in percent, occurring between two temperature levels. Typically, used to approximate unburned carbon in residue. (PTC 4-2013)

*lot of rupture disks:* those disks manufactured of a material at the same time, and of the same size, thickness, type, heat, and manufacturing process, including heat treatment. (PTC 25-2018)

*low-Btu gas:* synthesis gas produced by gasification with air, having a higher heating value below 7 MJ/N-m³
low heat value (LHV): the heat produced by combustion of a unit quantity of gaseous, liquid, or solid fuel under specified conditions, expressed in J/kg (Btu/lbm). All of the water in the product remains in the vapor phase. This value is calculated from higher heating value at constant volume for liquid fuel(s) and from the higher heating value at constant pressure for gaseous and solid fuel(s). (PTC 47.4-2015)

low heating value (LHV): the heat of combustion, per unit quantity of fuel when all combustion product water is assumed to remain as vapor. This is the lowest possible heat of combustion of a particular fuel at specified conditions and when used in calculations results in the highest values of power plant efficiency. (PTC 50-2002)

lower heating value: see heating value. (PTC 47-2006)

lower heating value (LHV) (liquid or gaseous fuels): the heat produced by combustion of a unit quantity of fuel at conditions such that all of the water in the products remains in the vapor phase. It is calculated from the higher heating value at a constant volume for liquid fuel(s), and from the high heating value at constant pressure for gaseous fuel(s). (PTC 22-2014)

lower heating value (LHV): the HHV of fuel minus the latent heat of vaporization of the combustion products when combustion products are cooled to 60°F. (PTC 4.4-2008)

lower heating value: total energy released by the fuel without condensation of the water vapor in the products of combustion. (PTC PM-2010)

lower heating value constant volume (LHVυ): HHVυ minus the latent heat of the condensed water vapor at the base temperature of 77°F (25°C). (PTC 55-2013)

L/G ratio: liquid-to-gas ratio is defined as the volumetric flow rate of reagent-laden liquid per volumetric flow rate of flue gas. Flue gas volume is typically based on saturated gas flow. (PTC 40-2017)

M

machine: any type of hydraulic turbine or pump-turbine. (PTC 18-2011)

macrofouling: fouling of the cooling water flow paths caused by debris. (PTC PM-2010)

main relieving valve: that part of a pilot-operated pressure relief device through which the rated flow occurs during relief. (PTC 25-2018)

makeup: water added to the system to replace water lost by evaporation, drift, blowdown, and leakage. (PTC 23-2003, PTC 51-2011)

makeup water: water supplied to the deaerator or condensate tank by external systems to replace system losses due to boiler blow-down, drainage, leakage, and nonreturning cogeneration steam loads. Makeup water is typically assumed to be saturated with oxygen. (PTC 30.1-2007)

make-up water: water added to the cycle to replace the steam and water lost. (PTC PM-2010)

manual recording system: a system by which substantially all the measurements are observed and recorded manually in a test log, even if they are later entered into a computer for data reduction and analysis. (PTC 30.1-2007)

marked breaking pressure: the value of pressure marked on a breaking pin or a shear pin device or its nameplate. (PTC 25-2018)

marked burst pressure: the value of pressure marked on the rupture disk device or its nameplate or on the tag of the rupture disk, indicating the burst pressure at the coincident disk temperature. (PTC 25-2018)
marked set pressure: the value or values of pressure marked on a pressure relief device. (PTC 25-2018)

margin: the positive or negative limit surrounding an desired value, in which an acceptable result may lie. (PTC 30.1-2007)

marked ratio: ratio of a transformer’s rated primary value to the rated secondary value as stated on the nameplate (PTC 19.6-2018)

marked relieving capacity: see rated relieving capacity. (PTC 25-2018)

mass median diameter (MMD): see $D_{\text{υ}0.5}$. (PTC 51-2011)

material balance: an accounting of the mass of material entering and leaving a process usually made on a time-related basis. (PTC 34-2017)

maximum continuous rating (MCR): see capacity (system). (PTC 4-2013, PTC 4.3-2017, PTC 34-2017)

maximum continuous rating: the contractual maximum continuous rating output from a steam generator. (PTC PM-2010)

material loss: the amount of mass leaving the test boundary from the storage container, which decreases the internal energy of the storage medium.

mean: the arithmetic average of $N$ readings of a measurand. (PTC 19.1-2018)

mean of the valve loops: a smooth curve which gives the same load-weighted average performance as the valve-loop curve. (PTC 6-2004) (PTC 6A-2000 qualifies this “for partial-admission turbines”)

measurand: the particular quantity that is being measured or estimated. (PTC 19.1-2018)

measured power output (electrical): power output measured at the test boundary. (PTC 47.4-2015)

measured relieving capacity: the relieving capacity of a pressure relief device measured at the flow-rating pressure, expressed in gravimetric or volumetric units. (PTC 25-2018)

measured thrust: the engine scale force measured by a load cell. (PTC 55-2013)

measured torque: the engine torque measured by a dynamometer or torque meter. (PTC 55-2013)


main air compressor: compressor that takes ambient air as feed and compresses it to the operating pressure of the ASU or gasifier. The compressor may supply all or part of the air requirement of the ASU or gasifier. (PTC 47-2006)

measurement error: the true, unknown difference between the measured value and the true value. (PTC Template)

measurement uncertainty: uncertainty associated with a measurand; a description for the estimate of the expected limits of measurement error. (PTC 19.1-2018)

measurement uncertainty: estimated uncertainty associated with the measurement of a process parameter or variable. (PTC 22-2014, PTC 30.1-2007, PTC 51-2011, PTC 70-2009)

mechanical draft: a type of ACC in which the air flow is effected by fans. In the typical ACC, these are motor-driven axial fans. (PTC 30.1-2007)
mechanical draft tower: type of cooling tower through which the air movement is effected by mechanical devices. See forced draft tower and induced draft tower. (PTC 23-2003, PTC 51-2011)

mechanical governor: refers to a governing system that uses a mechanical means for sensing and processing the speed of the unit. (PTC 29-2005)

medium-Btu gas: synthesis gas produced by gasification with oxygen, having a higher heating value between 7 MJ/N-m³ and 20 MJ/N-m³ (180 Btu/scf and 500 Btu/scf). (PTC 47-2006)

membrane filter: a membrane used in a separation process for water purification or as an analytical device for the detection of suspended solids or dissolved ionic constituents. (PTC 19.11-2008)

membrane systems: typically consist of all equipment, including service vessels, membranes, all piping, pumps, valves, controls, and instrumentation. (PTC 31-2011)

membranes: thin barriers or films of material that allow certain substances to pass through. (PTC 31-2011)

mesh: measure of the fineness of a screen in terms of the number of openings per inch. (PTC 47-2006)

meter: an SI unit of length, originally one ten-millionth of the distance along a meridian on earth from the equator to the pole. (PTC 19.5-2004)

microfiltration: process that discriminates between particles on the basis of size using a membrane with a usual pore size of 0.45 μm. (PTC 31-2011)

microfouling: fouling of the condenser tube surface due to microbiological growth, deposits, or corrosion. This inhibits heat transfer through the tube walls. (PTC PM-2010)

micron: measurement of size equivalent to 1 μm. (PTC 31-2011)

microphone: electroacoustic transducer that produces electric signals when excited by acoustic signals (PTC 36-2018)

millipore filter test: widely accepted visual indication, established by a special filtration test, used to determine concentration and nature of suspended metal oxides. Typically used on condensate samples. See Mandatory Appendix II. (PTC 31-2011)

mixed-bed unit: use of intimately mixed hydrogen form cation resins and hydroxide-form anion resins in a single ion exchange vessel; this type of equipment usually provides the highest quality treated water. (PTC 31-2011)

mixed resin unit (special ionic form): use of intimately mixed cation and anion exchange resin in forms other than hydrogen and hydroxide. Such units are used in some applications for treatment of contaminated steam condensate. Other applications find used in treatment of nuclear primary coolant and nuclear waste management flows, performing soluble radionuclide removal as well as filtering capability for particulate removal. (PTC 31-2011)

moisture: moisture in fuel is determined by appropriate ASTM standards. Water, in the liquid or vapor phase, present in another substance. (PTC 4-2013, PTC 4.3-2017)

moisture: moisture in fuel is determined by appropriate ASTM standards. Free moisture in coal is that portion of total moisture (ASTM test method D 3302) that is in excess of inherent moisture in coal (ASTM method D 1412); it is not to be equated with the weight loss upon air-drying. Free moisture is sometimes referred to as surface moisture in connection with coal or coke. Inherent moisture in coal is moisture that exists as an integral part of the coal seam in its natural state, including water in pores, but not that present in macroscopically visible fractures. Also water, in liquid or vapor phase, present in another substance. (PTC 47-2006)

moisture: water, in the liquid or vapor phase, present in another substance. (PTC 34-2017)
moisture: water, in the liquid or vapor phase, present in another substance. Moisture in fuel is determined by appropriate ASTM standards or other internationally recognized tables. (PTC 47.4-2015)

moisture removal zone (MRZ): provision in turbines of nuclear plants for removal of moisture. (PTC PM-2010)

moisture removal zone (MRZ) effectiveness: the ratio of the moisture removed to the total moisture entering the MRZ. (PTC PM-2010)

moisture removal zone (MRZ) effectiveness curve: relationship of MRZ effectiveness at various MRZ steam pressures. (PTC PM-2010)

moisture separator effectiveness: the ratio of moisture removed to the moisture entering the moisture separator. (PTC PM-2010)

moisture separator reheater (MSR): device used in nuclear units to decrease the moisture content and raise the temperature of the steam going to the LP turbine. (PTC PM-2010)

molecular weight: formula mass (PTC 12.2-2010)

moving-bed gasifier: type of gasifier characterized by the slow movement of hydrocarbon and ash particles down through a bed while reacting with gases moving up through the bed. (PTC 47-2006)

multibed systems: combination of cation and anion exchangers, usually in series flow and sometimes in combination with mixed-bed exchangers, for treating and processing water and/or dilute aqueous solutions. (PTC 31-2011)

multiparty test: performance test for an ACC where the results of the test are the substance of a contract. Typically, the parties are the Vendor and the Owner of the ACC. The testing agency is not one of the parties. (PTC 30.1-2007)

multiple-pressure HRSG: an HRSG system that exports steam at more than one pressure. (PTC 4.4-2008)

multiple-unit complex: a station in which there are several units, intended to be capable of simultaneous operation. (PTC 30.1-2007)

multiplexer: a device that combines two or more information channels onto a common transmission medium. (PTC 19.22-2007)

multi-pressure condenser: condenser that is partitioned so as to operate at more than one steam side pressure. (PTC PM-2010)

municipal solid waste (MSW): composed of unprocessed residential waste, yard waste, street waste, and may include similar forms of waste from commercial and industrial establishments, and institutions. (PTC 34-2017)

N

nanofiltration: membrane liquid separation technology that is positioned between reverse osmosis and ultrafiltration. While RO can remove the smallest of solute molecules, in the range of 0.0001 μm in diameter and smaller, nanofiltration (NF) removes molecules in the 0.001 μm range. NF is a polyamide membrane and is essentially a lower-pressure version of reverse osmosis where the purity of product water is not as critical as pharmaceutical grade water, for example, or the level of dissolved solids to be removed is less than what is typically encountered in brackish water or seawater. As such, nanofiltration is especially suited to treatment of well water or water from many surface supplies. NF membranes are often referred to as softening membranes because of their ability to remove divalent ions such as calcium and magnesium but allow a large percentage of monovalent ions such as sodium to pass through. (PTC 31-2011)
natural draft tower: type of cooling tower through which the air movement is affected by the difference in densities of the entering and exhaust air. (PTC 23-2003, PTC 51-2011)

near field: the part of the sound source field that lies between the source and the far field. In this region, the sound pressure does not decrease 6 dB for each doubling of distance from the source. (PTC 36-2018)

net flow area: the area that determines the flow after a nonreclosing pressure relief device has operated. The (minimum) net flow area of a rupture disk is the calculated net area after a complete burst of the disk, with appropriate allowance for any structural members that may reduce the net flow area through the rupture disk device. (PTC 25-2014)

net generation: difference between the electrical generator output and the auxiliary electrical power. (PTCPM-2010)

net generator output: generator electrical output after all generator losses and excitation power has been deducted. This is also the same as gross turbine output. (PTC 6.2-2011)

net heat of combustion at constant pressure: heat produced by combustion of a unit quantity of a solid or liquid fuel when burned, at a constant pressure of 0.101325 MPa (1 atm), under conditions such that all the water in the products remains in the form of vapor. (Note that the net calorific value is a lower heating value that can be calculated from the gross calorific value by making a correction for the difference between a constant-volume process and a constant-pressure process, and a deduction for the vaporization of the water in the combustion products, including both the water initially present as moisture and that formed by combustion.) (PTC 47-2006)

net power: the electrical power leaving the test boundary minus any electrical power entering the test boundary. (PTC 50-2002, PTC 70-2009)

net power output (electrical): power output determined from the measured power output by application of charges and credits as described in Section 5. (PTC 47.4-2015)

net shaft power: the engine power determined from the measured torque including the application of charges and credits described in Section 5 and calculations using shaft speed. (PTC 55-2013)

net thrust: the engine thrust determined from the measured thrust including the application of charges and credits described in Section 5. (PTC 55-2013)

net turbine electrical output: net generator output less steam turbine-generator auxiliary power. (PTC 6.2-2011)

noise: a disturbance that affects a signal and that may distort the information carried by the signal. (PTC 19.22-2007)

nonreclosing pressure relief device: a pressure relief device designed to actuate and remain open after operation. A manual resetting means may be provided. (PTC 25-2014; NPRDs may include one or more of the following design features):
(a) low-lift device: a device in which the actual discharge area is dependent on the lift of the disk.
(b) full-lift device: a device in which the actual discharge area is independent of the lift of the disk.
(c) reduced bore device: a device in which the flow path area below the seat is less than the flow path area of the inlet to the device.
(d) full-bore device: a device in which the flow path area below the seat is equal to the flow path area of the inlet to the device.

design types:
(a) rupture disk device: a device that contains a disk which ruptures when the static differential pressure between the upstream and downstream side of the disk reaches a predetermined value. A rupture disk device includes a rupture disk and may include a rupture disk holder;
(b) pin device: a device actuated by static differential pressure or static inlet pressure and designed to function by the activation of a load-bearing section of a pin that supports a pressure-containing member. A pin is the load-bearing element of a pin device. A pin device housing is the structure that encloses the pressure-containing members. Examples of these devices include the
(1) breaking pin device: a device actuated by static differential or static inlet pressure and designed to function by the breakage of load-carrying section of a pin which supports a pressure-containing member;

(2) buckling pin device: a device actuated by static differential or static inlet pressure and designed to function by the buckling of an axially-loaded compressive pin which supports a pressure-containing member;

(3) shear pin device: a device actuated by static differential or static inlet pressure and designed to function by the shearing of a load-carrying member which supports a pressure-containing member;

(c) fusible plug device: a device designed to function by the yielding or melting of a plug, at a predetermined temperature, which supports a pressure-containing member or contains pressure by itself;

(d) frangible disk device: see rupture disk device;

(e) bursting disk device: see rupture disk device;

(f) direct spring-loaded device: a device actuated by static differential pressure or static inlet pressure in which the disk is held closed by a spring. Upon actuation, the disk is held open by a latching mechanism;

(g) pilot-operated device: a device in which the disk is held closed by system pressure and the holding pressure is controlled by a pilot actuated by system pressure. The pilot may consist of one of the devices listed above.

nozzle: a primary pressure-containing component in a pressure relief valve that forms a part or all of the inlet flow passage. (PTC 25-2014)

nozzle: a generic term for any of the defined types of nozzles in this Code. The user should take into account the context in which the term is used and the individual nozzle of interest to determine which specific nozzle type applies for their specific situation. (PTC 51-2011)

nozzle area, nozzle throat area: see bore area. (PTC 25-2014, PTC 51-2011)

nozzle diameter: see bore diameter. (PTC 25-2014)

Nukiyama-Tanasawa: a three-parameter model curve fit describing the droplet-size distribution. (PTC 51-2011)

O

obscuration (optical concentration): the amount of incident laser light as measured by the detector that is “blocked” by the presence of the spray droplets. (PTC 51-2011)

octave: the interval between two sounds whose frequency ratio is 2:1. (PTC 36-2004)

octave band: sound contained within a restricted frequency band where the highest frequency is twice the lowest frequency. Octave and one-third octave (octave band divided into three parts) band measurements are found on acoustical instruments. See also ANSI/ASA S1.6. (PTC 36-2018)

off site regeneration processes: ion exchange unit regeneration performed off site to transfer regeneration waste disposal to a suitable facility. This is most easily accomplished by transfer of both the containment vessel and resin to the off site facility but may also involve transfer of resin only. (PTC 31-2011)

opacity: the degree to which light is blocked. With respect to industrial facilities, it is the measure of impenetrability of visible light to pass through the gases exhausted to the atmosphere. (PTC 70-2009)

open cycle: working fluid is primarily atmospheric air with heat addition through a direct combustion of fuel. (PTC 22-2014)

open cycle: thermodynamic power cycle in which the working fluid passes through the system only once and is then exhausted to the atmosphere. (PTC 47-2006)

open-loop heater/chiller system: a heating/chilling system that operates in such a way that the working fluid becomes entrained in the gas turbine inlet air stream. (PTC 51-2011)
opening pressure: the value of increasing inlet static pressure of a pressure relief valve at which there is a measurable lift, or at which the discharge becomes continuous as determined by seeing, feeling, or hearing. (PTC 25-2018)

operating capacity: true measure of a resin’s ability to remove a given number of ions from solution. It is defined as the number of exchangeable ions available under a given set of conditions. These conditions are variable from one case to the next, and consist of such parameters as influent composition, effluent requirements, flow rate, concentration of regenerant used (i.e., degree of regeneration), temperature, exhaustion and rinse end points, resin selectivity, and particle size. The operating capacity is commonly expressed in ratios, in which the numerator is the weight of ions removed and the denominator is the volume of the bed [i.e., pounds per cubic foot (lb/ft³), kilograins per cubic foot (kgr/ft³), or equivalents per liter (eq/L)]. (PTC 31-2011)

operating cycle: ion exchange process consisting of a regeneration phase and a service run. (PTC 31-2011)

organic sulfur: sulfur that is chemically bonded to coal hydrocarbons rather than to the inorganic ash constituents of coal. (PTC 47-2006)

organic trap: application of selected ion exchange resins to remove large organic molecules from water to be treated. This selection can be made in lieu of gravity separation and flocculation equipment, such as conventional clarifiers, to remove organics. (PTC 31-2011)

orifice area: see effective discharge area. (PTC 25-2018)

oscillator calibrator: an electronic microphone-calibrating device which generates a known sound pressure level in a closed cavity at a specified frequency. (PTC 36-2004)

osmosis: spontaneous transport (diffusion) of solvent across a semipermeable membrane that separates two solutions of different concentration. (PTC 31-2011)

osmotic pressure: pressure that must be applied to a more concentrated solution to halt flow through a semipermeable membrane from the less concentrated solution into the more concentrated solution. (PTC 31-2011)

out-of-tolerance: a condition in which a given measuring instrument or measuring system does not meet the designed prescribed limits of permissible error as permitted by calibrations, specifications, regulations, etc. (PTC 46-2015)

outlet size: the nominal pipe size of the outlet of a pressure relief valve, unless otherwise designated. (PTC 25-2014)

outlet size: the nominal pipe size of the outlet passage from a pressure relief device, unless otherwise designated. (PTC 25-2018)

outliers: a data point judged to be spurious. (PTC 4-2013, PTC 4.3-2017)

output: energy absorbed by the working fluid that is not recovered within the steam generator envelope. (PTC 4-2013, PTC 4.3-2017)

output: the power produced by the gas turbine or steam turbine, the electrical power produced by the generators or the electrical power output of the IGCC power block facility. (PTC 47.4-2015)

output: the energy absorbed by the working fluid that is not recovered within the steam generator envelope, such as energy to heat the entering air. (PTC 34-2017)

output performance: net generator output referenced to specified steam flows and conditions; an important parameter to verify a change in steam turbine efficiency. (PTC 6.2-2011)

output/loss method: a method by which boiler efficiency is determined by a measurement of the energy rejected
outside-in: term used in cartridge and membrane filtration to describe flow path of liquid from external passage to the inside. (PTC 31-2011)

overall efficiency: the discharge energy divided by the sum of charge energy, fuel energy, secondary energy, and standby energy during a storage cycle, expressed as a percentage. (PTC 53-2018)

overall heat-transfer coefficient: rate of heat transfer per unit of surface area and temperature difference. This quantity is the fundamental measure of the condenser performance. (PTC 12.2-2010).

overall heat transfer coefficient: the heat transfer rate per unit of heat transfer area per unit of effective mean temperature difference. (PTC 12.5-2000)

overlap of error bar: that portion of the uncertainty interval in which the true value must lie and still fall within the uncertainty interval of two or more measurements of the same value. (PTC 12.5-2000)

overpressure: a pressure increase over the set pressure of a pressure relief valve, usually expressed as a percentage of set pressure. (PTC 25-2018)

overspeed: the increase in speed (expressed in % of rated speed) following a sudden reduction of load demand. (PTC 29-2005)

oxygen-blown gasification: type of gasification in which relatively pure oxygen, usually above 85% volumetric purity, is the oxidizing agent for the partial combustion of the gasifier feed(s). (PTC 47-2006)

oxygenated treatment: a water treatment technique used primarily for supercritical and subcritical once-through, fossil-fired boilers. This treatment involves the use of oxygen at near neutral or slightly alkaline pH in high-purity condensate/feedwater (<0.15 S/cm cation conductivity). The principal advantage of the treatment is the reduction of preboiler corrosion and a subsequent reduction in transport of corrosion products to the boiler. (PTC 19.11-2008)

packed bed ion exchange: see ion exchange unit (packed bed). (PTC 31-2011)

parties to a test: those persons and companies interested in the results of a test (PTC 47.1-2017)

peat: an unconsolidated, hydrophilic, yellowish-brown to brownish-black, carbonaceous sediment, formed by accumulation of partially fragmented and decomposed plant remains in swamps and marshes, which retains more than 75% inherent moisture and less than 12% mineral matter in saturated natural deposits. (PTC 47-2006)

parallel operation: the generating unit supplies energy to an electrical network that also is supplied by other sources of electrical energy. (PTC 29-2005)

parameter: a direct measurement; also, a parameter is a physical quantity at a location that is sensed by direct measurement of a single instrument, or determined by the averaged measurements of several similar instruments of the same physical quantity. (PTC 51-2011)

parameter: a physical quantity at a location that is sensed by direct measurement of a single instrument, or determined by the averaged measurements of several similar instruments. (PTC 6.2-2011, PTC 46-2015, PTC 70-2009)

parameter: a direct measurement; a physical quantity at a location which is determined by a single instrument, or by the average of several measurements of the same physical quantity. (PTC 22-2014)

parameter: quantity that can be measured or taken from best available information, such as temperature, pressure, stress, or specific heat, to determine a result. The value used is called the assigned value. (PTC 19.1-2018)
**parameter:** a physical quantity at a location. The parameter can be determined by measurement with a single instrument, by the average of several measurements of the same physical quantity, or by computation from measurements of other physical quantities. (PTC 30.1-2007)

**parasitic power:** energy produced by the power plant and used within the fuel cell system. (PTC 50-2002)

**part load:** a GT operating condition wherein the power produced is less than base load. (PTC 4.4-2008)

**partial pressure:** the contribution to total pressure of a constituent of a gaseous mixture. (PTC 4.4-2008)

**particulate matter:** nonliquid matter, exclusive of gases, that is heterogeneously dispersed in water. (PTC 31-2011)

**parties to a test:** those persons and companies interested in the results. In commercial tests, it may include the owner(s), supplier(s), equipment manufacturers, architect, engineer, firms hired to conduct the tests, engineering analysts, financiers, and any of their representatives. In other noncommercial tests, the parties to a test may all be from the same company but represent different functions and interests (e.g., testing, analysis, plant operations, performance engineering, purchasing, research, and plant maintenance). (PTC 1-2015)

**parties to a test:** those persons and companies interested in the results. (PTC 1 Template, PTC 11-2008, PTC 29-2005, PTC 46-2015, PTC 47.4-2015)

**parties to a test:** those persons and companies participating in the test. (PTC 4.3-2017)

**parties to the test:** those persons and companies interested in the results of the test. For an acceptance test, the parties are those individuals designated in writing by the Owners or the Vendors to make the decisions required in this Code. (PTC 30.1-2007)

**parties to the test:** for acceptance tests, those individuals designated in writing by the purchaser and machine suppliers to make the decisions required in this Code. Other agents, advisors, engineers, etc. hired by the Parties to the Test to act on their behalf or otherwise, are not considered, by this Code, to be Parties to the Test. (PTC 18-2011)

**parties to the test:** for acceptance tests, those individuals designated in writing by the purchaser, lender’s engineer, architect engineer (or facility supplier), and machine suppliers to make the decisions required in this Code. Other agents, advisors, engineers, etc., hired by the parties to the test to act on their behalf or otherwise, may or may not be considered, by this Code, to be parties to the test. (PTC 70-2009)

**partition wall:** vertical interior wall, which is either transverse, longitudinal, or radial, that subdivides a mechanical or natural draft tower into cells. (PTC 23-2003)

**pass(es):** description of the system configuration in which the permeate from one module is the feedwater to a subsequent pass operating in series when permeate from the system is taken to service from the final pass only. (PTC 31-2011)

**peak load:** a GT operating condition wherein GT power production is at maximum value. (PTC 4.4-2008)

**pegging steam:** higher pressure steam used to maintain minimum pressure in a lower-pressure system. (PTC 4.4-2008)

**performance factor:** a generic term that describes a test goal that is used to define the overall performance characteristic of specific technology:

<table>
<thead>
<tr>
<th>Technology</th>
<th>Performance Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaporative cooling</td>
<td>Effectiveness</td>
</tr>
<tr>
<td>Fogging</td>
<td>Fogging performance factor</td>
</tr>
<tr>
<td>Chilling</td>
<td>N/A</td>
</tr>
<tr>
<td>Heating</td>
<td>N/A</td>
</tr>
</tbody>
</table>
performance monitoring: trending and evaluation of ACC performance during normal operation. (PTC 30.1-2007)

performance parameters: those variables in a cycle that can be measured or calculated that are indicative of the level of performance of a component or system. (PTC PM-2010)

performance test codes (PTCs): Documents that provide uniform rules and procedures for the planning, preparation, execution, and reporting of performance test results. Test results provide numerical characteristics to the performance of equipment, systems, and plants being tested. (PTC 1-2015)

permeate: purified liquid exiting the system. (PTC 31-2011)

pH: expression of the acidity of a solution; the negative logarithm of the hydrogen ion concentration (pH 1, very acidic; pH 14, very basic; pH 7, neutral). (PTC 31-2011)

phase-angle correction factor (PACF): ratio of the true power factor to the measured power factor. The phase-angle correction factor corrects for the phase displacement of the secondary current or voltage, or both, due to the instrument transformer phase angle(s). (PTC 19.6-2018)

phase angle of an instrument transformer (PA): phase displacement, in minutes of arc or radians, between the primary and secondary values. The phase angle of a current transformer is designated by the Greek letter β and is positive when the current leaving the identified secondary terminal leads the current entering the identified primary terminal. The phase angle of a voltage transformer is designated by the Greek letter γ and is positive when the secondary voltage leads the corresponding primary voltage. (PTC 19.6-2018)

PID: a controller strategy comprising the summation of Proportional, Integral and Derivative gain terms processing a composite error input to produce a governor output command. (PTC 29-2005)

pilot: the pressure- or vacuum-sensing component of a pilot-operated pressure relief valve that controls the opening and closing of the main relieving valve. (PTC 25-2018)

pinch point (evaporator): the temperature difference between the gas temperature exiting the evaporator section and the saturation temperature of the water in the drum. (PTC 4.4-2008)

pinch temperature: the minimal terminal temperature difference between GTE and fluid. (PTC 4.4-2008)

piston: the moving element in the main relieving valve of a pilot-operated piston-type pressure relief valve which contains the seat that forms the primary pressure containment zone when in contact with the nozzle. (PTC 25-2018)

pistonphone - a microphone calibrating device equipped with a reciprocating piston of measurable displacement that permits the establishment of a known sound pressure in a closed cavity. (PTC 36-2004)

plant heat rate, gross: total heat input [MJ/h (Btu/hr)] from all fuels and other energy streams to the IGCC plant divided by the gross power output at the gas and steam turbine generator(s) output terminals (kW). The calculation may be based on either higher heating value or lower heating value, as long as the selected heating value is consistently applied in all calculations. (PTC 47-2006)

plant heat rate, net: total heat input [MJ/h (Btu/hr) HHV basis] from all fuels and other energy streams to the IGCC plant divided by the net power output from the plant. The net power output is the difference between the sum of the gross power outputs from the gas and steam turbine generators’ terminals, less all electrical power consumed by the plant as auxiliary power. (PTC 47-2006)

point: established by one or more consecutive runs at the same operating conditions and unchanged wicket gate, blade or needle openings. (PTC 18-2011)
polarity: arrangement of test connections to a circuit that permits correct determination of the direction of power flow. In an AC circuit, power is regarded as being "delivered" to the load when instantaneous current flows into the load for positive instantaneous voltage swings and out of the load for negative instantaneous voltage. Instrument transformers are marked to allow correct polarity to be maintained. In general, if the marked primary terminals are connected to a phase voltage (for a VT) or toward the generator (for a CT) and the marked secondary terminals are connected to the phase voltage or line side current terminals on the instrument, the polarity will be correct for power measurements. (PTC 19.6-2018)

position transducer: a physical device for measuring servomotor position and the necessary electrical or mechanical devices to convert this information for use by the governor. (PTC 29-2005)

post-test uncertainty analysis: PTCs require a post-test uncertainty analysis to determine the uncertainty intervals for the actual test. This analysis should confirm the pretest systematic and random uncertainty estimates. It serves to either validate the quality of the test results or to expose problems. (PTC 1-2015)

popping pressure: the value of increasing inlet static pressure at which the disk moves in the opening direction at a faster rate as compared with corresponding movement at higher or lower pressures. (PTC 25-2018)

population: the set of all possible values of a parameter. (PTC 19.1-2018)

population mean: average of the set of all population values of a parameter. (PTC 19.1-2018)

population standard deviation: a value that quantifies the dispersion of a population. (PTC 19.1-2018)

power: net power output of generator. (PTC 29-2005)

power: the plant electrical power leaving the test boundary (PTC 46-2015)

power: the useful energy, per unit of time, delivered by the turbine or turbine generator unit. (PTC 6-2004, PTC 6A-2000)

power droop, permanent (also known as speed regulation): the ratio of a speed change to the resulting power output change. (PTC 29-2005)

power factor: the ratio of the true power (kW) to the apparent power (kVA). (PTCPM-2010)

power factor: ratio of the active power to the apparent power in a circuit; the cosine of the phase angle between sinusoidal voltage and current in an AC circuit. Power factor can never exceed 1.0. (PTC 19.6-2018)

power island: for a Rankine-cycle steam power plant, the portion exclusive of the fired steam generator and its auxiliaries and of the heat sink system. For a combined cycle power plant, the portion of the cycle that is exclusive of the heat sink system. (PTC 46-2015)

power output: electrical or mechanical output based upon direct measurement at the test boundary. (PTC 22-2014)

power turbine: the last turbine that drives a rotor or propeller. It is not coupled to the gas generator through a mechanical connection but only through an aerodynamic connection. Because of the aerodynamic connection it can produce high torque at low speeds. (PTC 55-2013)

power turbine: turbine that is driven by the gases from a gas generator, producing useful work (sometimes referred to as a free turbine). (PTC 47-2006)

prandtl number: ratio of momentum diffusivity to thermal diffusivity. (PTC 12.2-2010)

precision: closeness of agreement between repeated measurements, usually measured by the precision index of the measurements. (PTC 47-2006, PTC 47.4-2015, PTC PM-2010)

precision: the closeness of agreement between a group of measured values. (PTC 70-2009)
**precision error:** see error, random. (PTC 4.3-2017, PTC 47-2006, PTC 47.4-2015, PTC 70-2009)

**precision error:** see random error. (PTC Template, PTC 29-2005, PTC 34-2017, PTC 47.1-2017, PTC 50-2002)

**predictive maintenance:** maintenance activities that are performed based upon the prediction of failure sometime in the future. This is usually based upon past maintenance history, coupled with results from performance monitoring programs and other indicators of equipment condition. Predictive maintenance activities predict satisfactory performance until the next scheduled examination, or identify an emerging failure state. (PTCPM-2010)

**precooler:** heat exchanger or evaporative cooler that reduces the temperature of a fluid before initial compression. (PTC 47-2006)

**preheater:** heat transfer section where aerated water is heated. (PTC 4.4-2008)

**preliminary test run:** a test run, with records, that serves to determine if equipment is in suitable condition to test, to check instruments and methods of measurement, to check adequacy of organization and procedures, and to train personnel. (PTC 30.1-2007)

**preliminary test runs:** runs that, along with records, serve to determine if equipment is in suitable condition
(a) to test
(b) to check instruments and methods of measurement
(c) to check adequacy of organization and procedures
(d) to train personnel All parties to the test may make reasonable. (PTC 1-2015)

**pressure:** absolute fluid pressure. (PTC 12.2-2010)

**pressure, p:** normal force per unit area. Since pressure divided by density may appear in energy balance equations, it is sometimes convenient to consider pressure as a type of energy per unit volume. (PTC 11-2008)

**pressure:** normal force per unit area exerted by a fluid on a containing wall with respect to a reference. (PTC 19.2-2010)

**pressure, absolute:** normal force per unit area exerted by a fluid on a containing wall with respect to zero absolute pressure. Absolute pressure can be positive only. (PTC 19.2-2010)

**pressure, ambient:** normal force per unit area exerted by the atmosphere at a location (usually local barometric pressure). (PTC 19.2-2010)

**pressure-containing member:** a component which is exposed to and contains pressure. (PTC 25-2018)

**pressure, differential:** difference between any two pressures (PTC 19.2-2010).

**pressure differential:** difference between the inlet and outlet pressures, measured across the media. (PTC 31-2011)

**pressure drop:** loss of pressure due to friction in fluid system between two points. (PTC 12.2-2010)

**pressure, gauge:** normal force per unit area exerted by a fluid on a containing wall with respect to local ambient pressure. Gauge pressure can be either positive or negative. Common practice is to refer to negative gauge pressure as vacuum (PTC 19.2-2010).

**pressure loss:** loss of total pressure across the heat exchanger due to hydraulic resistance. (PTC 12.5-2000)

**pressure relief device:** a device designed to prevent pressure or vacuum from exceeding a predetermined value in a pressure vessel by the transfer of fluid during emergency or abnormal conditions. (PTC 25-2018)
pressure relief valve: a pressure relief device designed to actuate on inlet static pressure and to reclose after normal conditions have been restored. It may be one of the following types and have one or more of the following design features. (PTC 25-2014; also the source for all subsequent PRV definitions)

(a) low-lift PRV: a pressure relief valve in which the actual discharge area is the curtain area;
(b) full-lift PRV: a pressure relief valve in which the actual discharge area is the bore area;
(c) restricted-lift PRV: a full-lift pressure relief valve whose lift is restricted such that the capacity is reduced proportionally to the ratio of restricted-lift to full-lift.
(d) reduced-bore PRV: a pressure relief valve in which the flow path area below the seat is less than the flow area at the inlet to the valve;
(e) full-bore PRV: a pressure relief valve in which the bore area is equal to the flow area at the inlet to the valve and there are no protrusions in the bore;
(f) direct spring-loaded PRV: a pressure relief valve in which the disk is held closed by a spring;
(g) pilot-operated PRV: a pressure relief valve in which the disk is held closed by system pressure and the holding pressure is controlled by a pilot valve actuated by system pressure;
(h) conventional direct spring-loaded PRV: a direct spring-loaded pressure relief valve whose operational characteristics are directly affected by changes in the back pressure;
(i) balanced direct spring-loaded PRV: a direct spring-loaded pressure relief valve which incorporates means of minimizing the effect of back pressure on the operational characteristics (opening pressure, closing pressure and relieving capacity);
(j) internal spring PRV: a direct spring-loaded pressure relief valve whose spring and all or part of the operating mechanism is exposed to the system pressure when the valve is in the closed position;
(k) temperature and pressure relief valve: a pressure relief valve that may be actuated by pressure at the valve inlet or by temperature at the valve inlet;
(l) power-actuated PRV: a pressure relief valve actuated by an externally controlled power device.

pressure-retaining member: a component that holds one or more pressure-containing members together but is not exposed to the pressure. (PTC 25-2018)

pressure rise: the increase in pressure measured at the entrance to the turbine (expressed in % of steady-state penstock pressure) following sudden closure of the turbine-control mechanism. (PTC 29-2005)

pressure, static: pressure at a point where a fluid element is in equilibrium. Static pressure would be indicated by an instrument at rest with respect to the fluid. (PTC 19.2-2010)

pressure, total: pressure on a plane normal to local flow direction. It is the maximum value of pressure as a function of direction at a point. It is equal to the summation of static pressure and velocity pressure. Total pressure is indicated when a moving fluid is brought to rest at the instrument (PTC 19.2-2010)

pressure, velocity (for a flowing fluid): also called dynamic pressure. Velocity pressure (or head) is the net pressure increase that can be derived from complete conversion of the velocity (or dynamic energy) to pressure in a reversible process. (PTC 19.2-2010)

pressure vessel (media): device operating at greater than atmospheric pressure containing one or more types of media commonly used for filtration, ion exchange, or other processes. (PTC 31-2011)

pressure vessel (module): device containing one or more membrane elements. (PTC 31-2011)

pressurized water reactor plant: type of nuclear plant that utilizes heat generated in the reactor to indirectly generate main steam in steam generators for producing power in the main steam turbines. (PTC PM-2010)

pre-test uncertainty analysis: PTCs require a pre-test uncertainty analysis in order to effectively plan the test. A pretest uncertainty analysis allows corrective action to be taken prior to the test, either to decrease the uncertainty to a level consistent with the overall objective of the test or to reduce the cost of the test while still attaining the objective. (PTC 1-2015)

preventive maintenance: maintenance activities that are performed on a scheduled basis, sometimes following manufacturer recommendations. Preventive maintenance activities are all maintenance activities performed on a
primary element: the component of a differential pressure flow-metering run which is flanged or welded between specially manufactured pipe sections, across which the pressure drop is measured to calculate flow. The component may be an orifice plate, a nozzle, or a venturi. (PTC 6.2-2011, PTC 51-2011)

primary energy: the principal form in which energy is delivered to and from the ESS.

primary energy rate: the charge energy divided by the discharge energy during a storage cycle, expressed as kilowatthours per kilowatt-hour.

primary material: the principal form in which mass is delivered to and from the ESS.

primary measurement: those measurements that are used in the calculation of the test results. (PTC 47-2006)

primary parameter: a direct measurement and a physical quantity at a location that is determined by a single instrument, or by the average of several similar instruments, that is used in the calculations of test results. (PTC 51-2011)

primary pressure: the pressure at the inlet in a pressure relief device. (PTC 25-2018)

primary variables: those used in calculations of test results. They are further classified as:
(a) Class 1: primary variables are those that have a relative sensitivity coefficient of 0.2 or greater.
(b) Class 2: primary variables are those that have a relative sensitivity coefficient of less than 0.2.

primary winding (instrument transformer): transformer winding intended for connection to the circuit to be measured or controlled. (PTC 19.6-2018)

process variables: hot and cold stream inlet and outlet temperatures and flow rates. (PTC 12.5-2000)

product compressor(s): compressors that take oxygen or nitrogen products from the ASU and compress them to the pressures required by the gasification or gas turbine units. (PTC 47-2006)

proficiency testing: a determination of the laboratory calibration performance by interlaboratory comparisons or other means. (PTC 46-2015)

proportional gain: the magnitude of the step of the governor transient response with \( b_p = K_d = K_i = 0 \) and input signal \( x = 1 \). (PTC 29-2005)

pulse cleaning gas: high-pressure gas, such as nitrogen, steam, or cleaned syngas, used for cleaning the hot gas filter elements by dislodging the accumulated filter cake. (PTC 47-2006)

pump: a machine operating in the pumping mode. (PTC 18-2011)

pump-turbine: a machine that is capable of operating as a pump and as a turbine. (PTC 18-2011)

purge: to introduce air into the furnace or the boiler flue passages in such volume and manner as to completely replace the air or gas-air mixture contained within. (PTC 4-2013, PTC 4.3-2017)
purge: to introduce air, nitrogen, or another fluid into or from a piece of equipment in such volume and in a manner as to completely replace the air or gas–air mixture contained therein. (PTC 47-2006)

purge stream: process stream that exits the FGD system and is considered part of waste streams. It is controlled to maintain FGD system operating parameters and chemistry within a certain value. (PTC 40-2017)

Q

quantity: the property of a phenomenon, body, or substance, where the property has a magnitude that can be expressed as a number. (PTC 19.1-2018)

quantity: number of condenser tubes (or of condenser-tube passes). (PTC 12.2-2010)

quench gasification process: process employing cool liquid or cool gas in direct contact with a hot synthesis gas as a means of reducing the temperature of the synthesis gas exiting the gasification vessel. (PTC 47-2006)

R

ram test cell: engine tested at ram inlet conditions (elevated pressure and temperature) and at sea level static exhaust conditions. (PTC 55-2013)

ramp rate: the rate of change of charge power or discharge power of an ESS. (PTC 53-2018)

ramp rate: the average ramp rate is the load change divided by the amount of time required to move from the initial load to the final load. The instantaneous ramp rate is the slope at a given load in the measured load change process. (PTC 70-2013)

ramping rate for setpoint adjustment: the rate of change of a controlled variable expressed in units of setpoint per second. The setpoint should be calibrated in units of watts % of rated speed, % of servomotor position or any other controlled variable. (PTC 29-2005)

random error: sometimes called precision error; the true random error, which characterizes a member of a set of measurements. Varies in a random, Gaussian (normal) manner, from measurement to measurement. (PTC 30.1-2007, PTC 50-2002, PTC 51-2011)

random error: sometimes called precision error; a statistical quantity that is normally distributed. Random error results from the fact that repeated measurements of the same quantity by the same measuring system operated by the same personnel do not yield identical values. (PTC 34-2017)

random error, ε: sometimes called precision; error due to limitations or repeatability of measurements that characterizes a member of a set of measurements. Random error varies in a random Gaussian-normal manner, from measurement to measurement. (PTC 47.1-2017)

random error: the portion of total error that varies randomly in repeated measurements of the true value throughout a test process. (PTC 19.1-2018, PTC 22-2014, PTC 19.6-2018)

random error: a statistical fluctuation (in either direction) in the measured data due to the precision limitations of the measurement device. Also called precision error. (PTC 18-2011)

random error: sometimes called precision or precision error; the true random error which characterizes a member of a set of measurements. The random error varies in a random, Gaussian-normal manner, from measurement to measurement (PTC 19.22-2007, PTC 46-2015, PTC 70-2009).

random standard uncertainty of the sample mean: a value that quantifies the dispersion of a sample mean as given by eq. (3.3.3). (PTC 19.1-2018)

random uncertainty: uncertainty due to numerous small independent influences that prevent a measurement
random uncertainty: an estimate of the \( \pm \) limits of random error with a defined level of confidence (usually 95%). (PTC 29-2005, PTC 47.1-2017, PTC 51-2011)

random uncertainty: an estimate of the limits of random error with a defined level of confidence (usually 95%). (PTC 30.1-2007)

random uncertainty \((2S)\): an estimate of the plus or minus \((\pm)\) limits of random error with a defined level of confidence (usually 95% which requires sufficient degrees of freedom to have a Student’s t equal to 2). (PTC 46-2015)

range: an area between two limits within which a quantity is measured. Instrument setting used in order to measure or supply a set of input or output values. (PTC 19.22-2007).

range: difference between hot water and cold water temperatures. (PTC 23-2003, PTC 51-2011)

rank: see coal rank. (PTC 47-2006)

rated discharge energy: the discharge energy delivered from the ESS designated in a test plan (such as maximum, minimum, nominal, or guaranteed), which may be derived from contracts, specifications, nameplates, guarantees, or other sources. (PTC 53-2018)

rated lift: the design lift at which a valve attains its rated relieving capacity. (PTC 25-2018)

rated power: the power output of the power system when operating at specified control and ambient conditions. (PTC 50-2002)

rated power: power output of the gas turbine engine or power plant when operating at specified control and ambient conditions. (PTC 47-2006, PTC 70-2009)

rated power output (continuous rating): power output, stated or guaranteed under specified operating conditions and on the basis of continuous operation. (PTC 47-2006, PTC 47.4-2015)

rated relieving capacity: that portion of the measured relieving capacity permitted by the applicable code or regulation to be used as a basis for the application of a pressure relief device. (PTC 25-2018)

rated speed: the design speed for the generating unit. (PTC 29-2005)

rated speed: specified speed at the rated power output. (PTC 47-2006)

ratio correction factor \((RCF)\): ratio of the true ratio to the marked ratio on an instrument transformer. The primary current or voltage is equal to the secondary current or voltage multiplied by the marked ratio times the ratio correction factor. (PTC 19.6-2018)

raw data: unreduced data prior to the application of any calculations. (PTC 19.22-2007)

reactive power \([\text{expressed in volt-amperes reactive (var)}]\): amount of power delivered to the reactive component of a load. Reactive components cause a phase shift between voltage and current in an AC circuit. In an AC circuit with sinusoidal waveforms, reactive power is RMS volts multiplied by RMS amps and the sine of the phase shift. (See active power and apparent power.) (PTC 19.6-2018)

reactivity: measure of a hydrocarbon’s susceptibility to chemical change such as gasification. The higher the reactivity, the faster the rate of reaction at a given temperature. (PTC 47-2006)
reading: one recording of all required test instruments. (PTC 18-2011)

reagent: any chemical compound, usually an alkali, used in the FGD system either to remove SO2 by chemical reaction or to regenerate another chemical compound. (PTC 40-2017)

reagent liquor/slurry: medium by which one or more reagents are added to an FGD system process. (PTC 40-2017)

reheat: heat-addition process by which the temperature of the outlet flue gas (stack gas) from the absorber is increased. (PTC 40-2017)

recirculation: that portion of the tower exhaust air that re-enters the tower inlet. It can be expressed as a difference between the average entering and windward side wet-bulb temperatures. (PTC 23-2003, PTC 51-2011)

recirculation: the flow of ACC exit air that is entrained into the ACC inlet air flow. (PTC 30.1-2007)

recirculation (economizer): use of a portion of hot water leaving an economizer or feedwater preheater to increase the incoming water temperature. (PTC 4.4-2008)

records: a complete set of measurements for a particular point of operation of a nozzle. The measurement must be sufficient to determine all nozzle performance variables as defined in this standard. (PTC 51-2011)

recovery: measure (%) of how much of the feed stream is recovered as permeate. (PTC 31-2011)

recycle: the portion of the concentrate stream that is reclaimed by injection into, and blending with, the feedwater to the system. (PTC 31-2011)

recycle rate: the mass flow rate of material being reinjected into a furnace or combustion chamber. (PTC 4-2013, PTC 4.3-2017)

recycle rate: mass flow rate of material being reinjected into a piece of equipment, such as a furnace or combustion chamber, in order to reprocess unconverted material. (PTC 47-2006)

recycle ratio: the recycle rate divided by the fuel mass flow rate. (PTC 4-2013, PTC 4.3-2017)

redundant instrumentation: two or more devices measuring the same parameter with respect to the same location. (PTC 46-2015, PTC 51-2011)

reference conditions: those conditions of a test medium that are specified by either an applicable standard or an agreement between the parties to the test, which may be used for uniform reporting of measured flow test results. (PTC 25-2018)

reference conditions: the specified numerical values of all external parameters (i.e., parameters outside the test boundary that affect either the corrected heat rate or corrected net power). In addition, the specified secondary heat inputs and outputs are reference conditions such as those listed in para. 3-5.2. (PTC 34-2017)

reference conditions: process operating conditions defined by fixing four of the six variables (PTC 12.5-2000)

reference heat balance: diagram indicating the base thermodynamic conditions for the steam turbine to which test results are corrected. (PTC 6.2-2011, PTC 51-2011)

reference material: a material or substance of which one or more properties are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (PTC 46-2015)

reference standard: a traceable instrument or process to which a system is compared during calibration. (PTC 19.22-2007)
reference temperature: the datum temperature to which streams entering and leaving the steam generator envelope are compared for calculation of sensible heat credits and losses. (PTC 4-2013, PTC 4.3-2017, PTC 34-2017)

reference temperature: a selected temperature from which all properties are based. (PTC 4.4-2008)

reference standard: a standard, generally of the highest metrological quality available at a given location that includes all measuring and test equipment and reference materials that have a direct bearing on the traceability and accuracy of calibrations, from which the measurements made at that location are derived. (PTC 46-2015)

reflecting surface: an acoustically non-absorptive (acoustically hard) surface, as opposed to an acoustically absorptive (acoustically soft) surface. (PTC 36-2018)

refuse derived fuel: fuel produced by shredding municipal solid waste and perhaps processing the shredded material to expedite removal of extraneous noncombustible components such as glass, stone, and metals. (PTC 34-2007)

regenerable sorbent: sorbent used for removing impurities, such as sulfur compounds, from the syngas and having properties of being regenerated from an inactive (i.e., sulfided) form to an active (i.e., nonsulfided or oxide) form. The regeneration process may be of the online or off-line type. (PTC 47-2006)

regenerant: solution used to restore the activity of an ion exchanger. Acids are employed to restore a cation exchanger to its hydrogen form; brine solution may be used to convert the cation exchanger to the sodium form. The anion exchanger may be rejuvenated by treatment with an alkaline solution. (PTC 31-2011)

regeneration: replacement of contaminating ions on the resin exchange sites, removed from the influent water, with desirable ions present in the regeneration chemical, thereby restoring the resin to acceptable working condition. (PTC 31-2011)

regeneration (in place, in situ): procedure in which the regenerant solutions are brought to the exhausted resin in the service vessels, and regeneration is conducted. (PTC 31-2011)

regeneration efficiency: regeneration efficiency, a measure of regenerant utilization, is commonly expressed either as pounds of regenerant per kilgrain of exchange capacity as CaCO3/ft3, or as a percentage of what would be the stoichiometric quantity (one equivalent of regenerant per equivalent of ions exchanged). (PTC 31-2011)

regeneration level/dosage: weight of regenerant used per unit quantity of ion exchange material in a single regeneration. It is usually expressed in terms of pounds of regenerant (as 100%) per cubic foot of fully hydrated ion-exchange material, in a specific ionic form, measured after backwash and draining. (PTC 31-2011)

regeneration phase: cycle consisting of minimum of four steps: resin separation (backwashing) to clean the bed, introduction of the regenerant, slow rinse or displacement to push the regenerant slowly through the bed, and finally fast rinse to remove all traces of regenerant from the resin. In packed bed ion exchange systems, backwash may be infrequent or employ special procedures and/or special external vessels. (PTC 31-2011)

regenerator: vessel where the sulfided sorbent is regenerated to its active form. For metal oxide sorbents in a hot gas cleanup system, the regenerator converts the sorbent from the sulfide to oxide form. (PTC 47-2006)

reheater: a heat transfer section where steam returning from the steam turbine is heated to a higher temperature. (PTC 4.4-2008)

reheater: heat source in which additional thermal energy is added to a fluid after it has been initially and partially expanded. (PTC 47-2006)

reheater pressure drop: pressure drop encountered in the reheat section of the boiler including piping. (PTC PM-2010)
reheater terminal difference: the difference between the saturation temperature of the heating steam and the temperature of the cycle steam exiting the reheater in a nuclear plant. (PTC PM-2010)

reinjection: the return or recycle of material back to the furnace. (PTC 4-2013, PTC 4.3-2017)

reinjection: return or recycle of material back to a piece of equipment, such as a furnace. (PTC 47-2006)

rejection: measure (%) of the fraction of salts that does not pass through the membrane. (PTC 31-2011)

relative span factor (RSF): a dimensionless parameter indicative of the uniformity of the drop size distribution. It is given by $RSF = (D_{0.9} - D_{0.1}) / D_{0.5}$. (PTC 51-2011)

relative sensitivity coefficient: a nondimensionalized sensitivity coefficient. (PTC 19.22-2007)

relative sensitivity (influence) coefficient: percent change in result per percent change in measured parameter. (PTC 4.3-2017)

relative uncertainty: absolute uncertainty divided by the magnitude of the variable and is dimensionless; also called “per unit uncertainty” (PTC 11-2008)

relief valve: a pressure relief valve characterized by gradual opening that is generally proportional to the increase in pressure. It is normally used for incompressible fluids. (PTC 25-2018)

relieving conditions: the inlet pressure and temperature on a pressure relief device during an overpressure condition. The relieving pressure is equal to the valve set pressure or burst (or the rupture disk burst pressure) plus the overpressure. (The temperature of the flowing fluid at relieving conditions may be higher or lower than the operating temperature.). (PTC 25-2018)

relieving pressure: set pressure plus overpressure. (PTC 25-2018)

remote deaerator: a deaerator that is separate from the HRSG. (PTC 4.4-2008)

removal efficiency (%R): ratio of removed SO2 to input SO2, expressed in percent. (PTC 40-2017)

repeatability: agreement between two or more sets of results by the same laboratory, using the same operator and equipment, within specified limits. (PTC 47-2006)

repeatability: the random error of a method expressed as the agreement attainable between independent determinations performed by a single analyst. (PTC 34-2017)

repeatability: the measure of how closely the results of two test runs correspond. (PTC 46-2015)

reproducibility: the random error of determinations by different analysts in different laboratories. (PTC 34-2017)

reproducibility: agreement between results from two or more laboratories (different equipment, operators, date of test, and different portions of the same sample), within specified limits. (PTC 47-2006)

resealing pressure: the value of decreasing inlet static pressure at which no further leakage is detected after closing. The method of detection may be a specified water seal on the outlet or other means appropriate for this application. (PTC 25-2018)

reseating pressure: see closing pressure. (PTC 25-2018)

residue: solid material remaining after gasification. Residue consists of materials that are normally discarded, such as fuel ash, spent sorbent, inert additives, and unburned matter. (PTC 47-2006)

residue: the solid material remaining after combustion. Residue consists of fuel ash, spent sorbent, inert additives, and unburned matter. (PTC 4-2013, PTC 4.3-2017)
residue: the solid material remaining after combustion. Residue consists of fuel ash, spent and unreacted sorbent, inert additives, and unburned matter. (PTC 34-2017)

resin fouling: phenomenon in which weak organic acids are absorbed by strong base anion resins and are not fully removed during regeneration; instead accumulate in, block the exchange sites, thus diminishing the capacity of the resins. In addition, the effluent quality deteriorates resulting in leakage of the organic acids, greater leakage to total dissolved solids, equivalent higher conductivity and lower pH values. Larger rinse volumes requiring more time may also be incurred during the regeneration phase. Fouling of ion exchange resins may also be caused by impure grade of regenerants, high levels of influent turbidity during the service run, precipitation of slightly soluble salts, iron or manganese and bacteria, iron in the water being processed (also during the service run). (PTC 31-2011)

resin separation (backwash): separation of the anion resin from the cation resin in mixed bed or layered bed units by backwashing. Separation due to the difference in specific gravities of the anion resin and cation resin, normally the anion resin being lighter will float to the top of the cation resin. (PTC 31-2011)

resin trap: strainer used to prevent discharge of resins from exchanger vessels into the vessels’ effluent if the outlet distributor fails. (PTC 31-2011)

resistivity: the electrical resistance of a solution is a general property, and is not specific for any particular ion. A measurement of resistivity can determine the quality of the effluent from certain ion exchange processes and is an excellent method of assessing total salt content. The value is reported in MΩ/cm². (PTC 31-2011)

resolution: the minimum difference between two discrete values that can be distinguished by a measuring device. (PTC 19.22-2007)

resolution: the smallest observable increment of measurement. (PTCPM-2010)

result (R): a value calculated from a number of parameters. (PTC 19.1-2018)

resistance: heat-transfer resistance (PTC 12.2-2010)

reverberant field: the sound in an enclosed or partially enclosed space that has been reflected repeatedly or continuously from the boundaries. (PTC 36-2018)

reverse osmosis: essentially the same process as osmosis except that pressure is applied to the more concentrated solution to force solvent flow through the semipermeable membrane into the less concentrated solution. (PTC 31-2011)

reynolds number: ratio of inertial reaction per unit volume of fluid to viscous force per unit volume of fluid. (PTC 12.2-2010)

rinse: part of the regeneration phase of an ion exchange process in which water is passed through the bed of ion exchange material to remove the residual regenerant solution. (PTC 31-2011)

rinse requirement: measure of the volume of water used during regeneration before a resin can be put into service. Rinse requirements may be influenced by impure grade of regenerants, hydraulic channeling, contamination fouling, and deterioration of the resin. (PTC 31-2011)

Rosin-Rammler [Rosin Rammler Sperling Bennett (RRSB)]: a two-parameter model curve fit describing the droplet-size distribution. Refer to DIN Standard 66145. (PTC 51-2011)

routine performance test: a test to provide the analytical basis for comparison of the current performance of an ACC with its design or like-new condition. (PTC 30.1-2007)

run: complete set of observations made over a period of time with one or more of the independent variables maintained virtually constant. (PTC 4-2013, PTC 4.3-2017, PTC 34-2017, PTC 47-2006, PTC 47.4-2015)
run: comprises the readings and/or recordings sufficient to calculate performance at one operating condition. (PTC 18-2011, PTC 51-2011)

run: as used throughout this Code, a subdivision of the test. A run consists of a complete set of observations and recorded data taken at regular intervals, made for a period of time with the independent variables maintained constant within the variations permitted by the parties to the test. (PTC 40-2017)

runner: turbine runner or pump impeller. (PTC 18-2011)

rupture disk: the pressure-containing element in a rupture disk device that is designed to burst at its rated pressure at a specified temperature. (PTC 25-2014)

rupture disk holder: the structure which clamps a rupture disk in position. (PTC 25-2018)

safety relief valve: a pressure relief valve characterized by rapid opening or by gradual opening that is generally proportional to the increase in pressure. It can be used for compressible or incompressible fluids. (PTC 25-2014)

safety valve: a pressure relief valve characterized by rapid opening, and normally used to relieve compressible fluids. (PTC 25-2014)

salt passage: measure (%) of the dissolved salts passing through the membrane. (PTC 31-2011)

sample size: the number of observations or values available for a single measurand (PTC 19.1-2018)

sample standard deviation: a value that quantifies the dispersion of a sample of measurements as given by eq. (3-3.2). It is an estimate of the standard deviation of the population. (PTC 19.1-2018)

saturation temperature: the temperature for a given pressure at which water vaporizes to steam. (PTC 4.4-2008)

Sauter mean diameter (SMD): see $D_{32}$. (PTC 51-2011)

scaling: the method by which raw data is converted into engineering values. (PTC 19.22-2007)

scan: collection of data by a data acquisition system via a single sequential interrogation of devices, usually obtained through a multiplexer. (PTC 19.22-2007)

scan rate: the frequency at which a data acquisition system performs scans. Also known as sample rate. (PTC 19.22-2007)

SCR system: selective catalytic reduction system that is used to reduce the NOX levels in the GTE. (PTC 4.4-2008)

screw cooler: screw conveyor in which the flight and trough are cooled by a coolant such as water. It is used to cool and transport hot solids from a vessel. (PTC 47-2006)

sea level test cell: engine tested at sea level static conditions (both inlet and exhaust). (PTC 55-2013)

seal-off pressure: see resealing pressure. (PTC 25-2018)

seat: the pressure-sealing surfaces of the fixed and moving pressure-containing components. (PTC 25-2018)

seat angle: the angle between the axis of a valve and the seating surface. A flat-seated valve has a seat angle of 90 deg. (PTC 25-2018)

seat area: the area determined by the seat diameter. (PTC 25-2018)
seat diameter: the smallest diameter of contact between the fixed and moving portions of the pressure-containing elements of a valve. (PTC 25-2018)

seat flow area: see curtain area. (PTC 25-2018)

second: a measure of an interval in time, originally the period of a pendulum, 1 m in length at sea level and 45 deg of latitude. (PTC 19.5-2004)

secondary energy: the amount of nonfuel energy and/or nonprimary energy entering the ESS during a storage cycle. (PTC 53-2018)

secondary energy rate: the secondary energy divided by the discharge energy during a storage cycle, expressed as British thermal units per kilowatt-hour (kilojoules per kilowatt-hour). (PTC 53-2018)

secondary energy inputs: energy streams, exclusive of the heating value of main fuel supply crossing into the power plant boundary to support fuel cell systems. (PTC 50-2002)

secondary fuel input streams (multiple): all fuel input streams to the IGCC other than primary fuel. (PTC 47-2006)

secondary heat inputs: the additional heat inputs to the test boundary that must be accounted for, such as cycle makeup and process condensate return. (PTC 46-2015)

secondary measurements: measurements that are not required to calculate test results, but which may be required to determine that the plant is operating properly. (PTC 47-2006)

secondary parameter: a parameter that is not used in the calculation of test results, but is used to ensure the required test condition was not violated. (PTC 51-2011)

secondary parameters/variables: the parameters/variables that are measured but do not enter into the calculation of the test results. (PTC 46-2015)

secondary pressure: the pressure existing in the passage between the actual discharge area and the valve outlet in a safety, safety relief, or relief valve. (PTC 25-2018)

secondary outputs: any useful nonelectrical energy output stream which is used by an external process. (PTC 46-2015, PTC 50-2002)


secondary variables: variables that are measured but do not enter into the calculation of corrected performance. (PTC 47.4-2015)

secondary variables: variables that are measured but do not have a major effect on the result. (PTC 4.3-2017)

secondary thermal energy inputs: the additional heat inputs to the test boundary which must be accounted, such as cycle makeup and process condensate return. (PTC 50-2002)

secondary winding (instrument transformer): winding of a transformer that is intended for connection to the measuring, protection, or control device. (PTC 19.6-2018)

semipermeable membrane: membrane that allows some substances to pass through. (PTC 31-2011)

sensitivity: see influence coefficient. (PTC 47.1-2017, PTC 50-2002, PTC 47.4-2015)

sensitivity: see influence coefficient; the ratio of the change in a result to a unit change in a parameter. (PTC Template, PTC 18-2011, PTC 29-2005, PTC 30.1-2007, PTC 46-2015, PTC 51-2011, PTC 70-2009)
sensitivity: the rate of the change in a result due to a change in a variable evaluated at a desired test operating point. (PTC 19.1-2018)

sensitivity: the ratio of the change in a result to a change in a parameter; see absolute and/or relative sensitivity (influence) coefficient. (PTC 4.3-2017)

sensitivity coefficient: also called “sensitivity factor,” the ratio of the change in a result to a unit change in a parameter. Influence coefficients have been utilized in the derivations of the uncertainties equations in this Code. (PTC 11-2008, PTC 19.22-2007, PTC 30.1-2007)

sensitivity coefficient, absolute or relative: refer to ASME PTC 19.1 for definition. (PTC 46-2015)

sequential regeneration schedule: units of dissimilar types in a system are regenerated together, but one unit is fully regenerated before the other unit starts regeneration. (PTC 31-2011)

sequential valve (partial arc control): the operational mode to change turbine loading by which the steam flow into a turbine is governed by opening one or more control valves sequentially. (PTC PM-2010)

serialize: an instrument has been assigned a unique number and that number has been permanently inscribed on or to the instrument so that it can be identified and tracked. (PTC Template, PTC 29-2005, PTC 47.4-2015, PTC 50-2002)

serialize: to assign to an instrument a unique number that is then permanently inscribed on or to the instrument so that the instrument can be identified and tracked. (PTC 47.1-2017)

serialize: to permanently mark an instrument so that it can be identified and tracked. (PTC 11-2008)

service run: part of the operating cycle of an ion exchange process in which the influent is passed through a bed of the ion exchange material to exchange specific ions from the water for an equivalent amount of specific ions from the ion exchange material. (PTC 31-2011)

servomotor: the element of the governing system that moves the turbine-control mechanism. (PTC 29-2005)

servomotor capacity: product of the maximum servomotor stroke and the force of maximum servomotor pressure. (PTC 29-2005)

servomotor cushion time: the elapsed time that the rate of servomotor travel is retarded. (PTC 29-2005)

servomotor force: the opening and/or closing force generated by the servomotor. (PTC 29-2005)

servomotor stroke: the travel of the main servomotor from full closure of the turbine control mechanism to any intermediate position. The maximum servomotor stroke is the travel between full closure and full open stops of the turbine control mechanism. (PTC 29-2005)

servomotor time: the elapsed time for one full servomotor stroke at maximum velocity. (See Figure 2.3). (PTC 29-2005)

set pressure: the value of increasing inlet static pressure at which a pressure relief device displays one of the operational characteristics as defined under opening pressure, popping pressure, start-to-leak pressure, burst pressure, or breaking pressure. (The applicable operating characteristic for a specific device design is specified by the device manufacturer.). (PTC 25-2018)

setting infiltration: see air, infiltration. (PTC 4-2013, PTC 4.3-2017)

shaft specific fuel consumption: a measure of fuel consumption relative to shaft power. This applies to shaft power engines only. (PTC 55-2013)
shaft torque measurement system: a system to measure shaft engine torque with shafts and coupling spacers that transmit torque with torsional strain. Examples are surface strain systems, angular displacement systems, mechanical, electrical, and optical systems. (PTC 55-2013)

shaft work: mechanical energy crossing the power plant boundary for accomplishing useful work. (PTC 50-2002)

shear pin: the load-carrying element of a shear pin device. (PTC 25-2018)

shell: an assembly of pressure-containing members that isolate primary or secondary pressure from atmosphere. Examples of these members include, but are not limited to (a) for a direct spring-loaded PRV utilizing a pressurized bonnet, the body, nozzle, bonnet and cap (b) for a direct spring-loaded PRV utilizing a yoke or open bonnet, the nozzle and disk (c) for a pilot-operated PRV, the body and cap of the main valve and the body of the pilot (PTC 25-2018)

shutdown: the actions required to safely stop the electrical generation from an operating power producing facility. (PTC 70-2009)

signal conditioning: to modify a signal to make it suitable for measurement by data acquisition systems. (PTC 19.22-2007)

silt density index: widely accepted numerical indication, established by a special filtration test, used to predict colloidal particle fouling of membranes. (PTC 31-2011)

simmer: the audible or visible escape of fluid between the seat and disk at an inlet static pressure below the popping pressure and at no measurable capacity. It applies to safety or safety relief valves on compressible-fluid service. (PTC 25-2018)

single-party test: test of an ACC where the results of the test are not the substance of a contract. However, if a test agency performs the test on behalf of the party, the uncertainty of the test may be the substance of the contract with the test agency. (PTC 30.1-2007)

single pressure HRSG: an HRSG that exports steam at one pressure only. (PTC 4.4-2008)

single-shaft gas turbine engine: gas turbine engine in which all compressor and turbine stages are mechanically interconnected and operate at the same speed. (PTC 47-2006)

single-shaft turboshaft/turboprop engine: a gas turbine engine in which all compressor and turbine stages are mechanically connected and operated at the same speed. Excess turbine power is used to drive a propeller or rotor. (PTC 55-2013)

single-spool turbojet engine: a gas turbine engine in which all compressor and turbine stages are mechanically connected and operating at the same rotational speed. Gas flow is expanded through a nozzle for propulsive thrust. (PTC 55-2013)

single valve (full arc control): the operational mode to change turbine loading by which the steam flow into a turbine is governed by opening all control valves simultaneously. (PTC PM-2010)

slag: ash material that has been heated above its melting point and then solidified into an amorphous, glasslike form as it is cooled, typically by being quenched in water. An opening at the bottom of the gasifier (slag tap) is provided to allow this slag to exit from the gasifier. The slag is separated from the water in an accumulator where the slag settles and is subsequently depressurized. (PTC 47-2006)

slag: a semiliquid or solid mineral substance formed by chemical action and fusion at furnace operating temperatures accumulated on surfaces within the steam generator envelope. See also fouling. (PTC 34-2017)

slagging gasifier: type of gasifier in which the ash leaves as a molten slag rather than as a nonagglomerated solid. (PTC 47-2006)
sliding pressure: see variable pressure (PTC PM-2010)

slurry: mixture of liquid and suspended solids. (PTC 40-2017)

slurry: mixture of liquid with solid particles, usually for enabling the solid to “flow.” (PTC 47-2006)

sodium cycle: operation of a cation exchange cycle wherein the removal of specified cations from the influent water is accomplished by exchange with an equivalent amount of sodium ion from the exchange material. (PTC 31-2011)

softener: ion exchange equipment containing cation exchange resin used for the removal of hardness ions (calcium and magnesium), exchanging them for sodium ions. (PTC 31-2011)

soot blower: device using high velocity steam or air jets for cleaning solids from heat transfer surfaces. (PTC 34-2017)

sorbent: chemical compound(s) that reacts with and captures a pollutant or, more generally, a constituent that reacts with and captures another constituent. (PTC 4-2013, PTC 4.3-2017)

sorbet: an additive that reacts with and captures specific constituents of flue gas. (PTC 34-2017)

sorbet: additive that reacts with and captures a pollutant or, more generally, a constituent that reacts with and captures another constituent. (PTC 47-2006)

sorbet transport system: mechanical or pneumatic transport system for transporting the sorbent that is regenerated from one vessel to another. (PTC 47-2006)

sound: an oscillation in an elastic medium that can produce the sensation of hearing. Also, the sensation of hearing caused by a pressure oscillation. (PTC 36-2018)

sound absorption: reduction in sound energy as it reflects off a surface. (PTC 36-2018)

sound level: I: measured in decibels, a frequency-weighted sound-pressure level obtained using a sound-level meter whose weighting characteristics are specified in ANSI/ASA S1.4/Part 1/IEEE 61672-1. (PTC 36-2018)


sound-level meter: a device that is used to measure sound-pressure level, functioning in accordance with the standard specifications for sound-level meters established by ANSI/ASA S1.4/Part 1/IEEE 61672-1 and filters established by ANSI/ASA S1.11/Part 1/IEEE 61260-1 (PTC 36-2018)

sound power level \( (L_w) \): ten times the logarithm to the base ten of the ratio of the sound power produced by the sound source to the reference power of \( 10^{-12} \) watts (W). (PTC 36-2018)

sound pressure level \( (L_p) \): ten times the logarithm to the base ten of the ratio of the square of the sound pressure of the sound under consideration to the square of the standard reference pressure. The standard reference pressure is 20 micro pascals (μPa), or equivalently, \( 2 \times 10^{-5} \) N/m². (PTC 36-2018)

sound pressure level: the sound pressure level, in decibels (dB), of a sound is 20 times the logarithm to the base 10 of the ratio of the pressure of this sound to the reference pressure, 0.0002 microbars. It is the generally accepted unit of sound pressure level. (PTC 23-2003)

span: the difference between the two limits of a nominal range of a data acquisition system. (PTC 19.22-2007)

spatial technique: measurements of droplets contained within a volume under conditions such that the contents of
the volume do not change during any single measurement. (PTC 51-2011)

special moisture removal zone: special provision in LP turbines of nuclear plants to remove moisture. (PTC PM-2010)

specific energy, \( y \): energy per unit mass. Specific kinetic energy is kinetic energy per unit mass and is equal to one-half the square of the fluid velocity. Specific potential energy is potential energy per unit mass and is equal to the gravitational acceleration multiplied by the elevation above a specified datum. Fluid pressure divided by density is sometimes called “specific pressure energy” and is considered a type of specific energy; however, this term is more properly called specific flow work. (PTC 11-2008)

specific fuel consumption (mechanical or electrical): fuel consumption rate per unit of power output. (PTC 47-2006)

specific fuel consumption \([\text{ft}^3/(\text{kW} \cdot \text{h}), \text{or lbm}/(\text{kW} \cdot \text{h}), \text{or kg}/(\text{kW} \cdot \text{h})]\): fuel consumption rate per unit of power output. (PTC 50-2002)

specific humidity, \( s \): the mass of water vapor per unit mass of dry gas. (PTC 11-2008)

specific humidity: mass of water vapor in gas per pound of wet gas (also see humidity ratio). (PTC 4.3-2017)

specific power performance (SPP): unit of product per unit of power consumed (e.g., Mg O2/kW·h or short ton O2/kW·h)

specific volume: the volume of air-vapor mixture per unit mass of dry air. (PTC 23-2003, PTC 51-2011)

specified burst pressure (of a rupture disk device): the value of increasing inlet static pressure, at a specified temperature, at which a rupture disk is designed to function. (PTC 25-2018)

specified conditions: the specified contract design conditions of all parameters at the test boundary. See also standard conditions. (PTC 4.3-2017)

specified corrected net power test: a test run at a specified corrected net power that is near to the design value of interest; for example, an acceptance test where heat rate is guaranteed at a specific load and partial-load tests for development of heat-rate curve conditions. (PTC 50-2002)

specified corrected net power test: a test run at a specified corrected net power that is near to the design value of interest. A performance test is at the guaranteed point; tests at other points are demonstration tests. (PTC 47.4-2015)

specified corrected power test: a test run at a specified corrected power that is near to the design value of interest; for example, an acceptance test of a steam cycle plant where heat rate is guaranteed at a specific load, and partial-load tests for development of heat rate curve conditions. (PTC 46-2015)

specified disposition test: a test run at a specified plant disposition with both load and heat rate determined by the test. Examples of this test goal are valve-point testing on a steam cycle plant (including maximum capability testing) and base-load testing on a combined cycle plant with or without duct firing. (PTC 46-2015)

specified net power test: a test run at a specified net power regardless of ambient or other external conditions. An example of this test goal is acceptance test on a power system with an output guarantee over a range of ambient temperatures. (PTC 50-2002)

specified reference conditions: the values of all the conditions to which the test results are corrected. (PTC 22-2014)

specified reference conditions: the values of all the external parameters, i.e., parameters outside the test boundary, to which the test results are corrected. Also, the specified secondary heat inputs and outputs are specified reference conditions. (PTC 47.4-2015)
**speed**: rotational speed of the generating unit. (PTC 29-2005)

**speed adjustment range**: the difference (expressed in % of rated speed) between the maximum and minimum speed settings of the governor system. (PTC 29-2005)

**speed deviation**: the difference between the actual speed of rotation and a reference speed. (PTC 29-2005)

**speed droop, permanent**: the ratio of a relative speed change and the resulting relative servomotor position change. Logically this should be referred to as "position droop". See Figure 2-7. (PTC 29-2005)

**speed droop, temporary**: the equivalent permanent speed droop when \( b_p = K_p = K_d = 0 \) (for electronic-hydraulic governors) or when \( b_p = 0 \) and \( T_r = \infty \) (for mechanical-hydraulic governors). (PTC 29-2005)

**speed sensing device**: the means used to transmit a signal proportional to the speed of the turbine to the speed responsive elements. It can be mechanical, either through belts or gearing, or electrical, either through potential transformers in the driven generator leads or through an independent generator that is coupled to the main generator shaft. (PTC 29-2005)

**speed transducer speed sensing device**: for a transducer measuring turbine speed and the necessary electrical or mechanical devices to convert this information for use by the governor. (PTC 29-2005)

**speed responsive elements**: those elements that are directly responsive to speed, which determine speed error and influence the action of other elements of the governing system. (PTC 29-2005)

**spent bed material**: bed drain residue removed from a fluidized bed. (PTC 4-2013, PTC 4.3-2017, PTC 47-2006)

**spent sorbent**: solids remaining after evaporation of the moisture in the sorbent, calcination/dehydration, and weight gain due to sulfation. (PTC 4-2013, PTC 4.3-2017)

**spent sorbent**: solids remaining after sorbent, calcination/dehydration, and weight gain due to sulfation. (PTC 34-2017)

**spindle**: a part whose axial orientation is parallel to the travel of the disk. It may be used in one or more of the following functions: (a) assist in alignment, (b) guide disk travel, and (c) transfer of internal or external forces to the seats. (PTC 25-2018)

**spiral wound modules**: two layers of semipermeable membrane separated by a porous, woven fabric support and formed into an envelope that is then wound around a central perforated tube. (PTC 31-2011)

**splash out**: circulating water splashed from the tower that is not wind-induced. (PTC 23-2003)

**spring**: the element in a pressure relief valve that provides the force to keep the disk on the nozzle. (PTC 25-2018)

**spring button**: see spring step. (PTC 25-2018)

**spring step**: a load-transferring component in a pressure relief valve that supports the spring. (PTC 25-2018)

**spring washer**: see spring step. (PTC 25-2018)

**stability**: the capability of the governor system to position the turbine-control mechanism so that sustained oscillations of turbine speed or power output are not produced by the governor system during operation under steady-state load demand or following a change to a new steady-state load demand. Forced oscillations (i.e. "dither") of the governor system introduced to reduce friction are excluded because the dither frequency is generally high enough so no measurable oscillations are transmitted to the turbine-control mechanism. (PTC 29-2005)

**stabilization period**: the time period, prior to a test run, necessary to establish minimally changing operating
conditions that are required for a valid performance test. (PTC 30.1-2007)

stack: a vertical conduit to discharge the GTE to atmosphere. (PTC 4.4-2008)

stack damper: a damper that is closed when the HRSGs not operating to conserve heat (PTC 4.4-2008)

stage(s): description of the system configuration in which the concentrate from one module is the feedwater to a subsequent stage when the permeate from each combines as a single stream. (PTC 31-2011)

stand-alone air separation unit: air separation process that is not integrated with the gas turbine, having its own supply of feed air and providing products only to the gasification process, and usually characterized by low air pressure operation. (PTC 47-2006)

standard air composition (dry air molar basis): nitrogen, 78.0840%; oxygen, 20.9476%; argon, 0.9365%; carbon dioxide, 0.0319%. (PTC 4.4-2008)

standard atmospheric conditions: defined as 101.325 kPa (14.696 psia), 288.5 K (59°F), and relative humidity of 60%. (PTC 47-2006)

standard atmospheric conditions: 14.696 psia (101.325 kPa), 59°F (288.15 K), and relative humidity of 60%. (PTC 50-2002)

standard atmospheric conditions: 101.325 kPa (14.696 psia), 288.15 K (59°F), and relative humidity of 60%. [also called STP (standard temperature and pressure)]. (PTC 51-2011)

standard conditions: ambient conditions of 14.696 psia and 60°F. (PTC 4.4-2008)

standard conditions: the values of all the external parameters, i.e., parameters at the test boundary to which the test results are corrected. The standard conditions may be the specified design conditions or a set of user-defined boundary conditions. Non-contract boundary conditions are referred to within this document as standard conditions and are typically used for performance monitoring. (PTC 4.4-2017)

standard conditions (S): defined as 20°C (68°F) for temperature and 760 mm Hg (29.92 in. Hg) for atmospheric pressure. (PTC 40-2017)

standard deviation: several types of standard deviation are defined in statistical analysis (e.g., population standard deviation, sample standard deviation, standard deviation of the mean). In this Code, the term “standard deviation” refers to “standard deviation of the mean” unless otherwise specified. (PTC 4-2013)

standard deviation: several types of standard deviation are defined in statistical analysis—population standard deviation, sample standard deviation, and standard deviation of the mean (sometimes referred to as precision index). In this Code, the term “standard deviation” refers to sample standard deviation. (PTC 47-2006)

standard deviation: standard deviation of the mean unless otherwise specified. Several types of standard deviation are defined in statistical analysis (e.g., population standard deviation, sample standard deviation, and standard deviation of the mean). (PTC 4.3-2017)

standard error of estimate (SEE): the measure of dispersion of the dependent variable about a least squares regression or curve. (PTC 19.1-2018)

standard pressure and temperature: there are no single universally accepted values for standard pressure or temperature, but there are several prevailing reference sets used as standards. There is no inherent advantage to using any particular standard, but performance calculations are simpler and less susceptible to error if a single set of standards is used for all calculations. Standard pressure normally refers to standard atmospheric pressure at sea level, 0.1013245 MPa = 1.01325 bar (14.696 psia). Commonly used standard temperatures include 60°F (15.55°C) for industrial gases, 15°C (59°F) for ambient air, 0°C (32°F) for steam enthalpy tables, 400°F (−59.67°F = 222.22 K = −50.92°C) for gas enthalpy tables, and 25°C (77°F) for chemical reactions. (PTC 47-2006)
**standard reference condition:** the pressure, temperature, and physical state of a material at which the enthalpy of that material is defined as zero. Standard reference conditions form the basis for comparisons between different sets of data. The choice of standard reference conditions is arbitrary, although water and steam properties are typically compiled at the triple point of water, 273.16 K [0.01°C (32.018°F)]. See also reference conditions and test conditions. (PTC 47.4-2015)

**standard temperature and pressure (STP):** 101.325 kPa (14.696 psia), 59°F (288.15 K). (PTC 50-2002)

**standard volume of fuel gas (dry):** standard volume is based on a temperature of 15.5°C (60°F) and a pressure of 101.325 kPa (14.696 psia). In cases where gases being measured are partially saturated, corrections shall be applied to gas-volume measurements to correct for actual water-vapor content in the as-consumed gas. (PTC 47-2006)

**standby energy:** the amount of primary energy or fuel energy crossing the test boundary during the standby state. Standby energy may increase or maintain the internal energy of the storage medium or may be parasitic. (PTC 53-2018)

**standby interval:** a time duration during which the ESS is in the standby state. (PTC 53-2018)

**standby power:** the rate at which standby energy crosses the test boundary; the standby energy divided by the standby interval. (PTC 53-2018)

**standby state:** a condition in which neither the charging process nor the discharging process occurs. (PTC 53-2018)

**start-to-discharge pressure:** see opening pressure. (PTC 25-2018)

**start-to-leak pressure:** the value of increasing inlet static pressure at which the first bubble occurs when a pressure relief valve is tested by means of air under a specified water seal on the outlet. (PTC 25-2018)

**startup:** the actions required to safely reach a predefined minimum load for an electrical generation facility in a shutdown or off-line condition. (PTC 70-2009)

**start-up burner:** burner firing an auxiliary fuel (such as natural gas, propane, or light oil) used to preheat an equipment item to near its normal operating temperature. (PTC 47-2006)

**starvation process:** process used with weak acid cation resin regeneration to minimize production of free mineral acidity in the treated effluent. This is accomplished by the use of virtually stoichiometric regeneration dosages adjusted only for the alkalinity concentration in the acid dilution water. (PTC 31-2011)

**static blowdown:** the difference between the set pressure and the closing pressure of a pressure relief valve when it is not overpressured to the flow rating pressure. (PTC 25-2018)

**static pressure, ps, psa:** the pressure measured in such a manner that no effect is produced by the velocity of the flowing fluid. Similar to the static temperature, it would be sensed by a measuring instrument moving at the same velocity as the fluid. Static pressure may be expressed as either an absolute or gage pressure. Absolute static pressure is used as a property in defining the thermodynamic state of the fluid. (PTC 11-2008)

**static temperature, ts, Ts:** the temperature measured in such a way that no effect is produced by the velocity of the flowing fluid. It would be shown by a measuring instrument moving at the same velocity as the moving fluid. Absolute static temperature is used as a property in defining the thermodynamic state of the fluid. (PTC 11-2008)

**station electrical power:** total electrical power used at the station. This includes auxiliary equipment electrical power and power used by support facilities (e.g., office, lighting, tank farms, etc.). (PTC PM-2010)

**statistic:** any numerical quantity derived from the sample data. (PTC 19.1-2018)
state of charge: the fraction of rated discharge energy present in the ESS (PTC 53-2018)

steady state: condition of the system when transients (e.g., pressure, temperature, concentration, and flow rate) in the system have dampened out and the system is in chemical and thermodynamic equilibrium (PTC 40-2017)

steam bypass (steam turbine): steam bypassed around steam turbine to a condenser or some other heat sink. (PTC 4.4-2008)

steam bypass (superheater): amount of steam bypassed around a superheater or part of a superheater. (PTC 4.4-2008)

steam duct: the duct that conveys the entire flow of steam from the steam turbine to the heat transfer surface. The duct may include expansion joints, bypass spargers, drain pots, branch systems, and isolation valves. It is typically supplied and tested as part of the ACC. (PTC 30.1-2007)

steam path audit: an audit of the turbine steam path that is used to quantify associated performance losses for each nonstandard condition. These performance losses are determined by taking detailed physical measurements of the steam path during a turbine outage. (PTC PM-2010)

steam purity: amount of total dissolved solids in the steam. (PTC 4.4-2008)

steam quality: percentage by weight of steam in a mixture of water and steam. (PTC 4.4-2008)

steam rate: steam consumption per hour per unit output in which the turbine is charged with the steam quantity supplied. (PTC 6-2004, PTC 6A-2000)

steam trap: a device which permits the removal of condensate and air and other noncondensible gases, for steam systems at or below saturated steam temperature and prevents or limits the discharge of live steam. (PTC 39-2005)

steam turbine: turbine that is driven by steam produced in the gasification area and/or heat recovery steam generator coupled to the gas turbine, producing useful work. (PTC 47-2006)

steam turbine bypass: a condition of the unit operation in which some of the steam generated is discharged directly to the ACC, without passing through the steam turbine. (PTC 30.1-2007)

stem: see spindle. (PTC 25-2018)

steam flow rate: quantity of steam entering condenser per unit of time. (PTC 12.2-2010)

stoichiometric: see regeneration efficiency. (PTC 31-2011)

stoichiometric air: see air, theoretical. (PTC 34-2017)

stoichiometric ratio, inlet basis (SRI): moles of reactive alkali added per moles of SO2 inlet. SRI is normally used in dry-scrubbing processes (e.g., spray dryers, circulating-dry-scrubbers type dry reactors). (PTC 40-2017)

stoichiometric ratio, removal basis (SRR): moles of reactive alkali added per moles of SO2 removed. SRR is normally used in wet scrubbing processes. (PTC 40-2017)

storage container: a vessel, tank, reservoir, cavern, or other prescribed volume that holds primary material within the ESS. (PTC 53-2018)

storage cycle: a sequence comprising the charge process, a standby state, and the discharge process in which the state of charge is the same at the beginning and end of the sequence. (PTC 53-2018)

storage medium: the mechanical, chemical, or thermal material within the energy storage system whose internal energy is changed. (PTC 53-2018)
**strainer plate:** internal device, installed at the top or bottom of an ion exchange unit, or as a dividing plate between two compartments, equipped with strainers and that acts as a distributor and/or collector of service liquid and regenerant solutions in packed bed ion exchange units. (PTC 31-2011)

**stratification:** the condition in which an inlet air condition is measurably different (greater than the accuracy of instrumentation) throughout the flow stream in a given cross section of inlet air duct when operating an inlet air-cooling or air-heating system (also called nonhomogeneous). [NOTE: Preexisting stratification conditions caused by other equipment within the power plant (e.g., cooling towers, open air-cooled generator vents, finned-fan heat exchangers, etc.) can cause significant stratification that makes determination of stratification by the cooling or heating system impractical]. (PTC 51-2011)

**stratified (layered) bed unit:** application of layers of weak-acid and strong-acid cation exchange resins, or weak-base and strong-base anion exchange resins in ion exchange vessels. This application is typically made to improve treatment efficiency. (PTC 31-2011)

**student’s t:** coverage factor to calculate expanded uncertainty from the combined standard uncertainty for a specified level of confidence with v degrees of freedom. (PTC 19.1-2018)

**subcooled condensate:** water whose temperature is below the saturated steam temperature. (PTC 39-2005)

**subcooling:** the temperature reduction of the fluid below its saturation temperature. (PTC PM-2010)

**sulfation:** exothermic chemical reaction that takes place when calcium sulfide reacts with oxygen to form calcium sulfate. (PTC 47-2006)

**sulfation:** the exothermic chemical reaction that takes place when calcium oxide unites with oxygen and sulfur dioxide to form calcium sulfate. (PTC 4-2013, PTC 4.3-2017, PTC 34-2017)

**sulfidation:** exothermic chemical reaction that takes place when a metal oxide or other sorbent reacts with fuel sulfur to form metal sulfide. (PTC 47-2006)

**sulfider:** see desulfurizer. (PTC 47-2006)

**sulfur capture:** see sulfur retention. (PTC 4-2013, PTC 4.3-2017, PTC 47-2006)

**sulfur recovery:** conversion of sulfur-containing compounds in a concentrated acid gas stream to elemental sulfur or sulfuric acid. A commercial example is the Claus process, which partially oxidizes hydrogen sulfide to elemental sulfur and water. (PTC 47-2006)

**sulfur retention:** the fraction of the sulfur that enters with the fuel that does not leave the steam generator as SO2. (PTC 4-2013, PTC 4.3-2017)

**sulfur retention:** fraction of the sulfur that enters with the gasifier fuel that does not leave the gasifier as H2S and COS. (PTC 47-2006)

**superheat:** the temperature difference between the steam temperature and the saturation temperature. (PTC 4.4-2008)

**superheated steam:** steam at a temperature higher than its saturation temperature. (PTC 4.4-2008)

**superheater:** a heat transfer section where steam is heated to higher temperature. (PTC 4.4-2008)

**superimposed back pressure:** the static pressure existing at the outlet of a pressure relief device at the time the device is required to operate. It is the result of pressure in the discharge system from other sources. (PTC 25-2018)

**supplemental fuel:** fuel burned to supply additional thermal energy to the steam generator or to support
supplemental fuel: fuel burned to supply additional energy to the steam generator or to support combustion. (PTC 47.4-2015)

supplementary firing: see auxiliary firing. (PTC 4.4-2008)

supplementary fuel: fuel burned to supply additional energy to the steam generator. (PTC 34-2017)

surface area-length (absorption diameter): see $D_2$ (PTC 51-2011)

surface area mean diameter (SAMD): see $D_{10}$. (PTC 51-2011)

surface area ratio: the ratio of boiler heating surface areas such as superheater to reheater. (PTC PM-2010)

suspended solids: matter such as clay, silt, finely divided organic matter, plankton, and other microscopic organisms that give rise to turbidity. (PTC 31-2011)

swirl nozzle: a fogging nozzle in which water enters a whirl chamber behind the faceplate of a nozzle from an angle that is tangential to the orifice in the faceplate through one or more passages. Water flowing through the orifice is sheared into ligaments by the whirling movement of water flowing from the orifice. This type of nozzle is also referred to as pin-less-type nozzle. (PTC 51-2011)

synthesis gas (syngas) or fuel gas: gas produced by partial oxidation of the hydrocarbon feed. Raw syngas is gas that has not undergone contaminant removal; clean syngas has the bulk of impurities removed. The primary use of this gas is to fuel a gas turbine. (PTC 47-2006)

synthesis gas (syngas): the gas produced by partial oxidation of the hydrocarbon feed. Raw syngas is gas that has not undergone contaminant removal; clean syngas has had the bulk of impurities removed. The primary use of this gas is to fuel a gas turbine. (PTC 47.4-2015)

systematic error: sometimes called bias; the portion of total error that remains constant in repeated measurements of the true value throughout a test process. (PTC 22-2014)

systematic error: sometimes called bias; the true systematic or fixed error, that characterizes every member of any set of measurements from the population. It is the constant component of the total measurement error. (PTC Template, PTC 19.22-2007, PTC 29-2005, PTC 30.1-2007, PTC 46-2015, PTC 50-2002, PTC 70-2009)

systematic error: a reproducible inaccuracy that is consistently in the same direction. Systematic error is often due to a problem that persists throughout the entire experiment. Also called bias error. (PTC 18-2011)

systematic error: see bias error. (PTC 51-2011, PTC 47.4-2015)

systematic error: the portion of total error that remains constant in repeated measurements of the true value throughout a test process. (PTC 19.1-2018)

systematic error: the portion of total error that remains constant in repeated measurements of the true value throughout a test process. Also called bias error. (PTC 19.6-2018)

systematic error: sometimes called bias error; the difference between the average of the total population and the true value; the true systematic or fixed error that characterizes every member of any set of measurements from the population. (PTC 34-2017)

systematic error, $\beta$: sometimes called bias; the portion of the total measurement error, $\delta$, that remains constant in repeated measurement of the true value in a test process, which characterizes every member of any set of measurements from the population. Systematic uncertainty, $B$: an estimate of the plus/minus limits of systematic error, with a defined level of confidence (usually 95%). (PTC 47.1-2017)

systematic standard uncertainty: a value that quantifies the dispersion of a systematic error associated with the
systematic uncertainty: an estimate of the ± limits of systematic error with a defined level of confidence (usually 95%). (PTC Template, PTC 30.1-2007, PTC 46-2015, PTC 51-2011)

Systematic uncertainty: uncertainty due to such things as instrument and operator bias and changes in ambient conditions for the instruments. Systematic uncertainty is essentially “frozen” in the measurement system and cannot be reduced by increasing the number of measurements if the equipment and conditions of measurements remain unchanged. (PTC 11-2008)

systematic uncertainty: an estimate of the ± limits of systematic error with a defined level of confidence (usually 95%). (PTC 29-2005, PTC 47.1-2017, PTC 70-2009)

systematic uncertainty: the 95% confidence level estimate of the limits of a true systematic error, often determined by judgment. (PTC 19.22-2007)

\[ T \]

tail gas: off-gas from the regeneration process of the sorbent that is regenerated. This gas typically contains significant quantities of contaminants, such as H₂S and SO₂, and needs cleaning treatment prior to admission to the atmosphere. (PTC 47-2006)

temperature: the property of an object that determines the direction of heat flow when that object is placed in thermal contact with another object at a different temperature. (PTC 19.5-2004)

Test: single run or the combination of a series of runs for the purpose of determining performance characteristics. A test normally consists of two runs. (PTC 4-2013, PTC 47-2006, PTC 47.4-2015)

terminal temperature difference (TTD): the difference between the saturation temperature of the heating fluid at shell inlet pressure and the outlet temperature of the heated fluid. (PTC PM-2010)
A test is a group of test runs comprising a series of points and results adequate to establish the performance over the specified range of operating conditions. (PTC 22-2014, PTC 30.1-2007)

Test reading: a group of test readings taken over a specific time period over which operating conditions remain constant or nearly so. (PTC 51-2011)

Test reading: one recording of all required test instrumentation for the purpose of determining performance characteristics. (PTC 47-2006)
test reading: one time-coincident recording of all required test instrumentation for the purpose of determining performance characteristics. (PTC 47.4-2015)

test run: group of test readings taken while the facility is operating at steady state at a specified operating condition. (PTC 47-2006)

test run: a sequence of points that define a test or test segment. (PTC 55-2013)

test run: a complete set of data that permits analysis of capability per this Code. A test run typically lasts about 1 hr. (PTC 12.5-2000, PTC 30.1-2007)

test run: a group of test readings taken while the fuel cell power system is operating at steady state at a specified operating condition. (PTC 50-2002)

test run: a group of test readings. (PTC Template, PTC 11-2008, PTC 29-2005, PTC 46-2015, PTC 47.1, PTC 47.4-2015)

test run: group of readings taken over a specific time period over which operating conditions remain constant or nearly so. (PTC 22-2014)

test run: the readings and/or recordings sufficient to calculate performance through one set of operating conditions. (PTC 70-2009)

test tolerance: a commercial allowance for deviation from contract performance levels. Also called margin or allowance, and not further considered in ASME PTCs (see PTC 1). (PTC 30.1-2007)

test uncertainty: an estimate of the limit of error of a test result. It is the interval about a test result that contains the true value with a given probability or level of confidence. It is based on calculations utilizing statistics, instrumentation information, calculation procedure, and actual test data. ASME PTC 19.1 is the PTC Supplement that covers general procedures for calculation of test uncertainty. PTCs maintain a 95% level of confidence for which uncertainty is calculated as their standard. This confidence level therefore represents a 95% chance that the uncertainty interval contains the true value. (PTC 1-2015)

test uncertainty: uncertainty associated with a corrected test result. (PTC 22-2014, PTC 51-2011, PTC 70-2009)

test uncertainty: uncertainty of a test result. (PTC 19.1-20138)

test uncertainty: the overall uncertainty in results due to the combined effects of instrument inaccuracy, transient conditions, and reading and methodological errors. (PTC 30.1-2007)

theoretical air: see air, theoretical. (PTC 34-2017)

theoretical free mineral acidity (TMA): free mineral acidity that would result from the conversion of all of the anions of strong acids in solution to their respective free acids. (PTC 31-2011)

theoretical relieving capacity: the computed capacity expressed in gravimetric or volumetric units of a theoretically perfect nozzle having a minimum cross-sectional flow area equal to the actual discharge area of a pressure relief valve or net flow area of a nonreclosing pressure relief device. (PTC 25-2018)

thermal conductivity: rate of heat transfer per unit of distance within a material (with values as listed in a recognized Standard). (PTC 12.2-2010)

thermal effectiveness: percentage of input energy captured for useful purpose which includes conversion to electric energy, shaft work, and thermal energy recovery for external uses. (PTC 50-2002)

thermal efficiency: the ratio of the energy output (electrical and shaft) to the energy supplied to the power system,
expressed as a percentage. In most fuel cell systems shaft work is not produced. For these systems thermal efficiency is synonymous with electrical efficiency. Thermal efficiency differs from thermal effectiveness in that is does not include utilized heat output. In mathematical terms:

\[
\text{thermal efficiency} = \frac{E_n + W}{Q_{\text{total}}}
\]

where

- \(E_n\) = net electrical energy output
- \(Q_{\text{total}}\) = total energy into the system
- \(W\) = shaft work (PTC 50-2002)

thermal efficiency: ratio of the power produced to the fuel energy supplied per unit time. Thermal efficiency may be expressed on either a lower heating value or higher heating value basis. (PTC 22-2014)

thermal efficiency: ratio of the energy output to the energy supplied to the GCC facility, expressed as a percent. (PTC 47-2006)

thermal island: for a Rankine-cycle steam power plant, the portion of the cycle consisting of the fired steam generator and its auxiliaries. For a combined cycle power plant, “it is synonymous with power island” or “the thermal island is equivalent to the power island.” (PTC 46-2015)

thermal kit: a compendium of performance information, generally provided by the turbine-generator manufacturer. These include heat balances of the turbine cycle and correction curves to heatrate and load for deviations from rated values of selected performance parameters. The thermal kit is strictly intended for verification of turbine-generator contractual performance guarantees and contains several assumptions regarding components outside the scope of the turbine-generator contract. However, it does yield useful information that very often serves as the basis for designing the other components in the turbine cycle. (PTC PM-2010)

thermal performance: the capability of the ACC at operating conditions compared against established design criteria. Fan power or other ancillary factors may be included. (PTC 30.1-2007)

thermal lag: the time interval before the temperature of the water leaving the hot water temperature measurement point is detected at the point of cold water temperature measurement. (PTC 23-2003)

thin film composite: membrane consisting of a thin semipermeable skin on thicker porous backing. (PTC 31-2011)

thoroughfare regeneration: regeneration of a weakly functional resin using waste dilute regenerant chemical from a strongly functional resin in a downstream position. In some cases the waste regenerant from the strongly functional resin is further diluted before injection into the upstream unit. (PTC 31-2011)

three-spool turbofan engine: similar to two-spool turbofan engine except that the gas generator is configured on two spools. (PTC 55-2013)

throat area: see bore area. (PTC 25-2018)

throat diameter: see bore diameter. (PTC 25-2018)

throttle flow: steam flow at the turbine inlet. (PTC PM-2010)

thrust specific fuel consumption: a measure of fuel consumption relative to net thrust. This applies to thrust engines only. (PTC 55-2013)

thrust stand: a mechanism for mounting a jet engine in a test cell and measuring thrust with a combination of flexors and load cells. The thrust stand can be mounted on the floor or overhead. (PTC 55-2013)

timesharing: a single analyzer receiving two or more separate sample streams on a time-share basis. (PTC 19.11-2008)

time synchronization: adjusting the system time on one or more data acquisition systems to ensure consistency
tolerance: a commercial allowance for deviation from contract performance levels. (PTC 22-2014)

tolerance or margin: a commercial allowance for deviation from contracted performance levels. (PTC 55-2013)

tolerance: acceptable difference between the test result and its nominal or guaranteed value. Tolerances are contractual adjustments to test results or to guarantees and are not part of the Performance Test Codes. (PTC 4-2013, PTC 4.3-2017, PTC 47-2006, PTC 47.4-2015)

topping cycle: higher temperature thermodynamic power cycle of a combined-cycle system. (PTC 47-2006)

tone: a sound wave capable of exciting an auditory sensation of pitch (see also, discrete function). (PTC 36-2018)

total error: unknown difference between measurement of a parameter or test result and its true value. (PTC 19.1-2018)

total error: the true, unknown difference between the measured value and the true value. The total error consists of two components: systematic error and random error. (PTC 18-2011)

total error: the closeness of agreement between a measured value and the true value. (PTC 46-2015)

total (measurement) error: the true, unknown difference between the assigned value of a parameter or test result and the true value. (PTC 51-2011)

total measurement uncertainty: the uncertainty in measurement due to the combined effects of all systematic error (or bias) and random error associated with instrument calibration, spatial variation, installation practices, data acquisition, and process variations. (PTC 12.5-2000)

total organic carbon (TOC): the amount of carbon bound in an organic compound often used as a nonspecific indicator of water quality, expressed as milligrams per liter (mg/L). (PTC 31-2011)

total pressure: sometimes called the stagnation pressure, would be measured when a moving fluid is brought to rest and its kinetic and potential energies are converted to an enthalpy rise by an isentropic compression from the flow condition to the stagnation condition. It is the pressure sensed by an impact tube or by the impact hole of a Pitot-static tube when the tube is aligned with the local velocity vector. Total pressure may be expressed as either an absolute or gage pressure. In a stationary body of fluid, the static and total pressures are numerically equal. (PTC 11-2008)

total temperature: sometimes called stagnation temperature, the temperature that would be measured when a moving fluid is brought to rest and its kinetic potential energies are converted to an enthalpy rise by an isentropic compression from the flow condition to the stagnation condition. At any point in a stationary body of fluid, the static and total temperatures are numerically equal. (PTC 11-2008)

total uncertainty: of a result is obtained by combining the random and systematic uncertainties of that result in a manner that reflects the confidence level. In this Code, random and systematic uncertainties are combined using a “root sum square (RSS) model.” (PTC 11-2008)

tower pumping head: total head of water at the centerline of the circulating water inlet to the cooling tower, referred to the tower basin curb as a datum. It is the sum of the static pressure measured at the centerline of the inlet connection to the cooling tower, the velocity pressure at this point, and the vertical distance between this point and the top of the basin curb. (PTC 23-2003)

traceability: see calibration hierarchy. (PTC 19.1-2013)

traceability: the property of the result of a measurement whereby it can be related to appropriate standards, generally national or international standards through an unbroken chain of comparisons. (PTC 46-2015)
traceable: term used to describe instruments for which records are available demonstrating that the instrument can be traced through a series of calibrations to an appropriate ultimate reference such as the National Institute of Standards and Technology (NIST). (PTC 47.1-2017)

traceable: availability of records demonstrating that the instrument or calibration gas can be traced through a series of calibrations to an appropriate ultimate reference such as National Institute for Standards and Technology (NIST). (PTC 4.3-2017, PTC 47.4-2015)

traceable: records are available demonstrating that the instrument can be traced through a series of calibrations to an appropriate ultimate reference such as National Institute for Standards and Technology (NIST). (PTC Template, PTC 11-2008, PTC 19.6-2018, PTC 29-2005, PTC 46-2015, PTC 50-2002, PTC 51-2011)

train interconnection: ion exchange unit interconnection method where all units dissimilar type or function are interconnected, operated, and regenerated as a discrete set. (PTC 31-2011)

transducer: a device that converts signals from one format to another. (PTC 19.22-2007)

transformer correction factor (TCF): ratio of the true watts or watt-hours to the measured secondary watts or watt-hours divided by the marked ratio. (PTC 19.6-2018)

transmission: 1 – obscuration, or if obscuration is a percent value, then it is equal to the quantity of (100 – obscuration)%). (PTC 51-2011)

transmission dynamometer: device that measures the torque transmitted from one machine to another, without appreciably affecting the torque. (PTC 47-2006)

transmitter: a device used to broadcast a signal that is usually a function of an input to the device. (PTC 19.22-2007)

true value: the error-free value of a measurand or test result. (PTC 19.1-2018)

true ratio: ratio of the root-mean-square (rms) primary voltage or current to the rms secondary voltage or current in a transformer under specified conditions. This is the value that results from application of correction factors and may be different than the marked ratio or nominal ratio. (PTC 19.6-2018)

tube diameter: diameter of condenser tube (PTC 12.2-2010)

turbine: a machine operating in the turbine mode. (PTC 18-2011)

turbine: a rotating device that takes working fluid at high pressure and temperature and expands it through a series of stationary nozzles and rotating blades to produce power. This power is used to drive the compressor, fan, accessories, rotor, and/or propeller. (PTC 55-2013)

turbine: mechanical rotary component that produces work by action of the working fluid. (PTC 47-2006)

turbine choke point: the operating condition at which further reductions in pressure at the LP turbine exhaust flange result in no increase in turbine output for a given set of upstream conditions. This condition is typically caused by attaining sonic (choked) flow conditions somewhere within the LP turbine. (PTC PM-2010)

turbine-control mechanism: includes those elements of the turbine that control the energy input to the turbine and the system of connected linkage that is actuated by the governor-control mechanism. (PTC 29-2005)

turbine efficiency: the ratio of the actual enthalpy change in the turbine to the isentropic enthalpy change (see enthalpy-drop test). (PTC PM-2010)

turbine exhaust: the exhaust connection of the steam turbine. It may be a flange or a landing bar for a weld. The turbine exhaust is typically not supplied with the ACC but forms the inlet steam flow boundary of the ACC test. See also condenser pressure. (PTC 30.1-2007)
turbine exhaust pressure: the LP turbine exit pressure measured at the exhaust flange. This is sometimes referred to as back pressure. It may not be the same as the condenser pressure. (PTC PM-2010)

turboshaft with power turbine engine: a gas turbine engine in which the compressor and power-balancing turbine stages are mechanically connected (typically called a gas generator). Gas generator gas flow is expanded through a power turbine on a separate shaft, which drives a propeller or rotor. (PTC 55-2013)

tubular element: membrane is inserted into, or coated onto, the inside surface of a porous tube that may range in size from 30 mm to 250 mm (1/8 in. to 1 in.) diameter. (PTC 31-2011)

turbidity: an expression of the optical properties of a sample that causes light rays to be scattered and absorbed rather than transmitted in straight lines through the sample. This is generally due to the presence of suspended matter. (PTC 31-2011)

turns ratio of a current transformer: ratio of the secondary winding turns to the primary winding turns. This may not be the same as the marked ratio or nominal ratio. (PTC 19.6-2018)

turns ratio of a voltage transformer: ratio of the primary winding turns to the secondary winding turns. This may not be the same as the marked ratio or nominal ratio. (PTC 19.6-2018)

tuyeres: injection ports through which oxidant is fed into certain types of gasification vessels. (PTC 47-2006)

two-spool turbofan engine: a gas turbine engine in which the compressor and power-balancing turbine stages are mechanically connected (typically called a gas generator). A second spool includes a fan and turbine. Airflow through the fan is split between the gas generator and around it along a bypass duct. Gas flow from both streams is expanded through separate nozzles or mixed and expanded through a single nozzle for propulsive thrust. (PTC 55-2013)

two-spool turbofan with afterburner: similar to two-spool turbofan. Bypass and gas-generator exhaust streams are mixed and combusted in an afterburner. Afterburner exit gas is expanded through a nozzle for propulsive thrust. (PTC 55-2013)

type A uncertainty: uncertainties are classified as Type A when data is used to calculate a standard deviation for use in estimating the uncertainty. (PTC 19.1-2018)

type B uncertainty: uncertainties are classified as Type B when data is not used to calculate a standard deviation, requiring the uncertainty to be estimated by other methods. (PTC 19.1-2018)

U

ultrafiltration: process like microfiltration, which discriminates between particles on the basis of size using a membrane with a pore size range of 0.0015 μm to 0.2 μm. (PTC 31-2011)

ultra pure water: water with a specific conductance less than 1.0 μS/cm² or greater than 10MΩ/cm². (PTC 31-2011)

unburned carbon: carbon in the fuel that has not changed to CO or CO₂ during the combustion process. (PTC PM-2010)

unburned combustible: combustible portion of the fuel that is not completely oxidized. (PTC 4-2013, PTC 4.3-2017, PTC 47-2006, PTC 34-2017)

uncertainty: the limits of error within which the true value lies. (PTC 19.1-2013)

uncertainty: a possible value for the error. It is also the interval within which the true value can be expected to lie with a stated probability. The uncertainty is used to estimate the error. (PTC 11-2008).
uncertainty: a band within which the true value is expected to lie with a certain probability. (PTC 34-2017)

uncertainty: the interval about the measurement or result that contains the true value for a 95% confidence level. (PTC 22-2014)

uncertainty: the interval about the measurement or result that contains the true value for a given confidence level (usually 95%). (PTC 12.5-2000, PTC 18-2011, PTC 46-2015, PTC 47.1-2017, PTC 70-2009)

uncertainty: the ± interval about the measurement or result that contains the true value for a given confidence level. (PTC 1-2015, PTC 19.22-2007, PTC 50-2002, PTC 51-2011)

uncertainty: the interval about the measurement or result that contains the true value for a given confidence level. (PTC 47.4-2015)

uncertainty (U): the interval about the measurement or result that contains the true value for the measured quantity for a given confidence level. (PTC 19.6-2018)

uncertainty: the estimated error limit of a measurement or result for a given coverage. Uncertainty defines a band within which the true value is expected to lie with a certain probability. Test uncertainty includes both random uncertainty and systematic uncertainty. (PTC 4-2013, PTC 4.3-2017)

uncertainty: the ± interval about the measurement or result that contains the true value for a given confidence level. (PTC 29-2005)

uncertainty: the estimated error limit of a measurement, comprised of both the random and bias (fixed) components. (PTC PM-2010)

uncertainty: the estimated error limit of a measurement or result for a given range. (PTC 55-2013)

uncertainty interval: an interval expressed about a measurand or test result that is expected to contain the true value with a prescribed level of confidence. (PTC 19.1-2018)

uncertainty, random: numerical estimate of the random errors. It is usually quantified by the standard deviation of the mean for a set of test data. (PTC 4-2013, PTC 47-2006)

uncertainty, random: an estimate of the plus-or-minus limits of random error with a defined level of confidence (usually 95%). (PTC 4.3-2017, PTC 47.4-2015)

uncertainty: an estimate of the limit of the error of a test result; the interval about the measurement or result that contains the true value for a given confidence level. (PTC 30.1-2007)

uncertainty, systematic: numerical estimate of the systematic error. (PTC 4-2013, PTC 47-2006)

uncertainty, systematic: an estimate of the plus-or-minus limits of systematic error with a defined level of confidence (usually 95%). (PTC 4.3-2017, PTC 47.4-2015)

uncertainty, test: combines random and systematic uncertainties. (PTC 4-2013, PTC 4.3-2017, PTC 47-2006)

unit: a system comprising one or more boilers or heat-recovery steam generators (HRSGs), one steam turbine and the ACC serving it; may also refer to the ACC alone. (PTC 30.1-2007)

units of measurement: units used to express concentrations, based on number, volume, or weight.

equivalents per liter (eq/L): concentration of ion equivalents that can be removed per liter of solution. An equivalent is the molecular weight in grams of the compound divided by its electrical charge or valence. For example, a resin with an exchange capacity of 1 eq/L could remove 37.5 g of divalent zinc (Zn^{2+}), molecular weight of 65, from solution. Since 1 eq/L is equal to 21.8 kgr/ft, equivalents per liter can be converted to kilograins per cubic foot by multiplying by 21.8.
kilogram per cubic foot (kg/ft³): the weight of ions, expressed as calcium carbonate (CaCO₃) equivalents that can be removed by a cubic foot of ion exchange resin. Kilograms per cubic foot can be converted to equivalents per liter by dividing by 21.8 or to pounds of calcium carbonate (CaCO₃) equivalents by dividing by 7.0.

milligram per liter (mg/L): number of thousandths of a gram of a substance in one liter of water. To convert from moles to milligrams, multiply the number of moles by the atomic or molecular weight of the substance and multiply by one thousand.

moles per liter: number of particle of a substance, expressed in moles, in one liter of water. One mole is $6.02 \times 10^{23}$ particles. Moles per liter (molarity) is abbreviated M. Thus, $10^{-7}$ M H⁺ equals $6.02 \times 10^{16}$ hydrogen ions per liter.

parts per million (ppm): parts by weight of an ion or species in a given weight of solution. Thus, 0.025 g of calcium ion in one liter of water is 25 ppm, or 25 parts by weight in 1,000,000 parts by weight of solution.

parts per billion (ppb): parts by weight of an ion or species in a given weight of solution. Thus, 0.000025 g of calcium ion in one liter of water is 25 ppb, or 25 parts by weight in 1,000,000,000 parts by weight of solutions.

parts per trillion (ppt): parts by weight of an ion or species in a given weight of solution. Thus, 0.000000025 g of calcium ion in one liter of water is 25 ppt, or 25 parts by weight in 1,000,000,000,000 parts by weight of solutions.

percent (volume/volume): percent of total solution volume contributed by the dissolved species that has been added to the solution. Thus, 40% (v/v) methanol is 40 mL of methanol in enough water to bring the solution to 100 mL.

percent (weight/weight): percent of total solution weight contributed by the dissolved species. Thus, 10% KNO₃ (w/w) is 10 g of KNO₃ in 90 g of water. If not otherwise specified, percent implies percent by weight. (PTC 31-2011)

unit thermal efficiency: the ratio of the net generator output to the total heat input to the boiler. (PTC PM-2010)

univariate correction: a correction that is a function of only one independent parameter. (PTC 6.2-2011, PTC 51-2011)

user defined: a set of boundary conditions that may reflect typical fuel and operating conditions, which may be something other than design conditions. (PTC 4.3-2017)

valence: all ions carry a charge that may be positive or negative. The amount and direction of the charge is the valance of the ion. A positively charged ion is a cation while a negatively charged ion is an anion. For example, calcium is a divalent cation bearing two positive charges while sodium is monovalent bearing one positive charge. (PTC 31-2011)

valve-loop curve: the continuous curve of actual heat rate for all values of output over the operating range of the unit. (PTC 6-2004)

valve point: the valve position just before the succeeding valve starts to open. (PTC PM-2010)

valve point loading: the technique of loading a unit at its valve points to maximize its efficiency. (PTC PM-2010)

valves wide open (VWO): the valve setting that corresponds to all turbine control valves fully open. (PTC PM-2010)

valve points: those valve positions which correspond to the low points of the valve loop curve. (PTC 6-2004)

valves wideopen: maximum control valve opening obtainable under normal turbine control system operation. (PTC 6-2004, PTC 6A-2000)
vapor-tight pressure: see resealing pressure. (PTC 25-2018)

variable: an indirect measurement that is an unknown physical quantity in an algebraic equation that is determined by parameters. (PTC 46-2015)

variable: summation indicator (PTC 12.2-2010)

variable: an unknown quantity in an algebraic equation that must be determined. (PTC 6.2-2011, PTC 51-2011)

variable: a quantity subject to variation such that it can have different values that can be measured or counted, and may be calculated from a number of measurands. (PTC 19.1-2018)

variable: a quantity that cannot be measured directly, but is calculated from other measured parameters. (PTC 22-2014, PTC 70-2009)

variable back pressure: a superimposed back pressure that will vary with time. (PTC 25-2018)

variable pressure operation: an operating method in which the load is changed by varying throttle pressure in lieu of changing valve position (multiple combinations of valve position may be utilized). (PTC PM-2010)

variation: in a test parameter, the slope of the linear least square fit of the parameter versus time multiplied by the time period of the test run. (PTC 30.1-2007)

velocity pressure, pv: sometimes called “dynamic pressure,” is defined as the product of fluid density and specific kinetic energy. Hence, velocity pressure is kinetic energy per unit volume. If compressibility can be neglected, it is equal to the difference of the total pressure and the static pressure at the same point in a fluid and is the differential pressure, which would be sensed by a properly aligned Pitot-static tube. In this Code, the indicated velocity pressure, pv, shall be corrected for probe calibration, probe blockage, and compressibility before it can be called velocity pressure. (PTC 11-2008)

verification: confirmation that the instrument meets the technical specifications claimed by the manufacturer. (PTC 19.6-2018)

verification: a set of operations which establish evidence by calibration or inspection that specified requirements have been met. (PTC 22-2014, PTC 46-2015, PTC 51-2011)

vignetting (optical cutoff): an optical effect that occurs when the diffraction from any droplet in the spray is at such an angle that it reached the plane of the receiving lens outside the aperture of the lens. In general, the farthest edge of the spray should be within the “working distance” of the collecting lens, as defined by the instrument manufacturer. (PTC 51-2011)

viscosity: intensity of viscous shear within a fluid (PTC 12.2-2010)

volatile matter: portion of mass, except water vapor, that is driven off in a gaseous form when solid fuel is heated in accordance with the applicable ASTM standard; see also fixed carbon. (PTC 4-2013, PTC 4.3-2017, PTC 47-2006)

voltage transformer (VT): instrument transformer that is used to reduce a high voltage to a proportionately lower voltage that may be safely applied to a measuring instrument. (PTC 19.6-2018)

volume length (evaporation) diameter (ED): see D31. (PTC 51-2011)

volume mean diameter (VMD): see D30. (PTC 51-2011)

W

warn: see simmer. (PTC 25-2018)
**waste**: material generated by the removal of SO2 with the FGD system that has no commercial value and requires disposal; it may include purge streams. (PTC 40-2017)

**water carryover (general)**: water in the form of droplets or coalesced and flowing along inlet surfaces that cross the defined test boundary. In the case of inlet fogging, this would be water droplets that enter the compressor or flow along the inlet bell mouth and inlet struts. In the case of inlet-chilling or inlet-fogging systems, the boundary will generally be upstream of the inlet silencing panels. (PTC 51-2011)

**water consumption**: water evaporated into the inlet air stream. (PTC 51-2011)

**water discharge**: water streams including blowdown, drain flow, condensed water, and other water effluent streams from the boundary, as applicable. (PTC 51-2011)

**water preheater (feedwater)**: see preheater. (PTC 4.4-2008)

**waste fuel**: discarded combustible substances destined for disposal. (PTC 34-2017)

**wet-bulb depression**: the difference between dry-bulb and wet-bulb temperatures. (PTC 51-2011)

**wet-bulb depression, \(td - tw\)**: the difference between the dry-bulb and wet-bulb temperatures at the same location. (PTC 11-2008)

**wet-bulb temperature, \(tw\)**: the temperature measured by a thermometer or other sensor covered by a water-moistened wick and exposed to gas in motion. When properly measured, it is a close approximation to the temperature of adiabatic saturation. (PTC 11-2008)

**wet-bulb temperature**: the temperature indicated by a properly designed wet-bulb instrument. This closely approximates the thermodynamic wet-bulb temperature (i.e., temperature of adiabatic saturation). (PTC 23-2003, PTC 51-2011)

**wind wall**: the vertical perimeter walls above the fan deck. (PTC 30.1-2007)

**windage**: wind-induced loss of circulating water. (PTC 23-2003)

**working fluid**: gas or liquid stream from which work is extracted, such as by powering a gas turbine. (PTC 47-2006)

**X**

**X-ratio**: the ratio of the heat capacity of the air passing through the air heater to the heat capacity of the gas passing through it. (PTC PM-2010)

**X-ratio**: see heat capacity ratio. (PTC 4.3-2017)

**Y**

**yard**: a unit of length containing 36 in.; in Great Britain, it is the distance, at 62°F, between two transversalines in gold plugs set in a bronze bar, called the British Imperial Yard, and kept at the Standards office of the Board of Trade at Westminster. (PTC 19.5-2004)

**yield (melt) temperature**: the temperature at which the fusible material of a fusible plug device becomes sufficiently soft to extrude from its holder and relieve pressure. (PTC 25-2018)

**yoke**: a pressure-retaining component in a pressure relief device that supports the spring in a pressure relief valve or pin in a nonreclosing device but does not enclose them from the surrounding ambient environment. (PTC 25-
Zeolite: group of complex hydrated aluminum silicates, either naturally occurring or synthetically manufactured with limited cation exchanged properties. (PTC 31-2011)

zero offset: the magnitude of the output signal when the input signal is zero. (PTC 19.22-2007)